The American Journal of Surgery

EDITED BY THURSTON SCOTT WELTON, M.D.

December 1945

Proctology . Obstetrics

Urology . Vascular Surgery

Orthopedic Surgery . Plastic Surgery

Fifty-fourth Year of Continuous Publication

The American Journal of Surgery

49 WEST FORTY-FIFTH STREET · NEW YORK 19

EDITORIAL BOARD

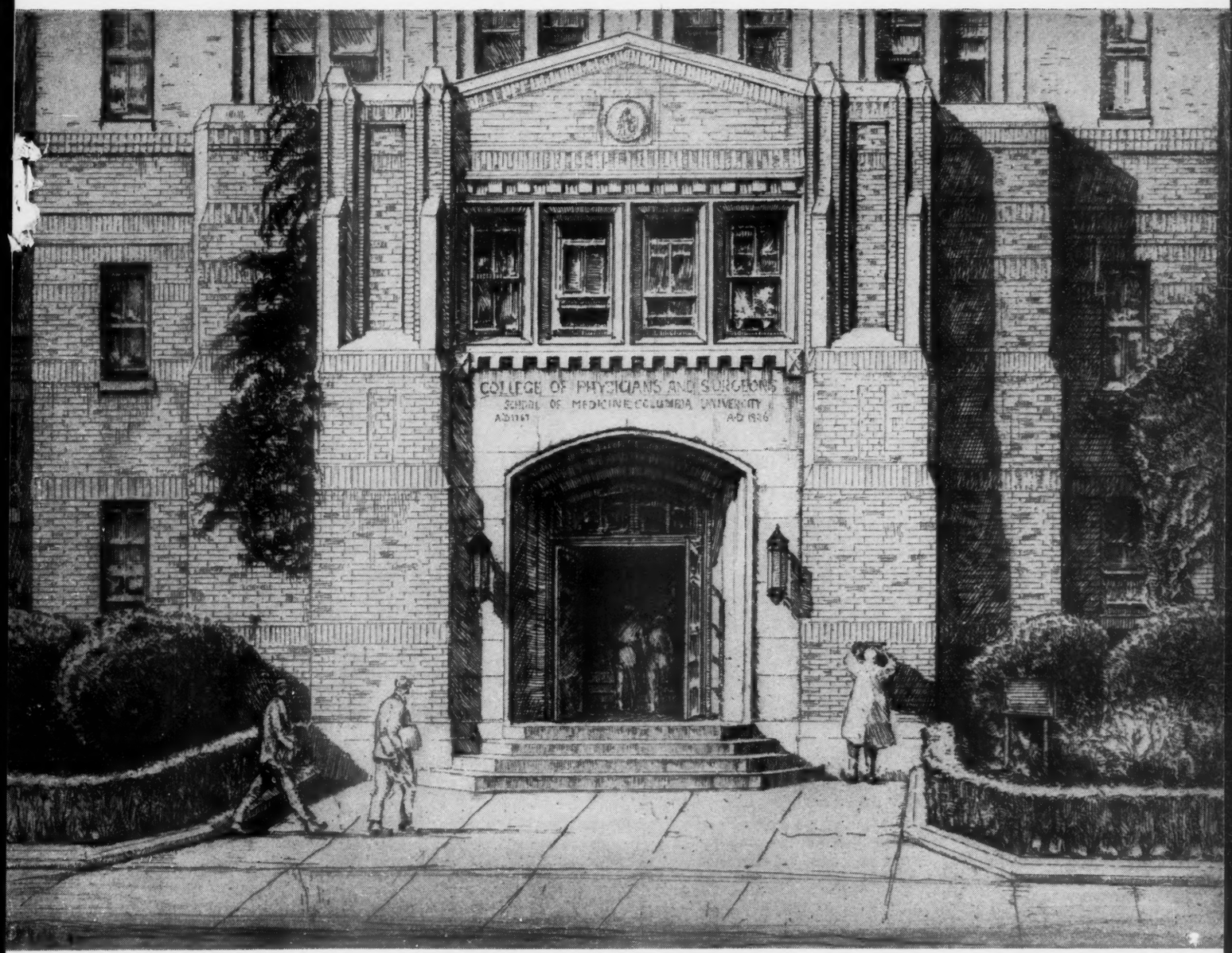
The American Journal of Surgery

Editor THURSTON SCOTT WELTON, *New York*

ASSOCIATE EDITORS

CARL BECK, *Chicago*
CLAUDE S. BECK, *Cleveland*
GEORGE R. BRIGHTON, *New York*
MEREDITH F. CAMPBELL, *New York*
JAMES T. CASE, *Chicago*
ISIDORE COHN, *New Orleans*
BRADLEY L. COLEY, *New York*
FREDERICK A. COLLER, *Ann Arbor*
PAUL C. COLONNA, *Philadelphia*
ELLIOTT C. CUTLER, *Boston*
CHARLES A. ELSBERG, *New York*
HERBERT C. FETT, *Brooklyn*
JOHN H. GIBBON, *Philadelphia*
EMIL GOETSCH, *Brooklyn*
CHARLES A. GORDON, *Brooklyn*
DONALD GUTHRIE, *Sayre, Pa.*
ARTHUR E. HERTZLER, *Kansas City*
LOUIS J. HIRSCHMAN, *Detroit*
JAMES M. HITZROT, *New York*
EMILE F. HOLMAN, *San Francisco*
CLAUDE J. HUNT, *Kansas City, Mo.*
ARNOLD S. JACKSON, *Madison, Wis.*
WILLIAM L. KELLER, *Washington*
THOMAS J. KIRWIN, *New York*
New York, ARTHUR KRIDA
New York, ADRAIN V. S. LAMBERT
New York, MAURICE LENZ
New York, H. H. M. LYLE
New York, JEROME M. LYNCH
New Orleans, URBAN MAES
Newark, HARRISON S. MARTLAND
New Orleans, RUDOLPH MATAS
Detroit, ROY D. MCCLURE
San Francisco, H. C. NAFFZIGER
Baltimore, EMIL NOVAK
Newark, CLARENCE R. O'CROWLEY
Boston, LOUIS E. PHANEUF
New York, EUGENE H. POOL
Rochester, Minn., JAMES T. PRIESTLEY
New York, DOUGLAS QUICK
Brooklyn, NATHANIEL P. RATHBUN
Raleigh, HUBERT A. ROYSTER
Philadelphia, HENRY S. RUTH
St. Louis, M. G. SEELIG
New York, J. BENTLEY SQUIER
New York, H. J. STANDER
Baltimore, GRANT E. WARD
San Francisco, J. HOMER WOOLSEY

The American Journal of Surgery is published monthly by The Yorke Publishing Co., Inc. 49 West 45th Street, New York 19, N. Y. Yearly Subscription, $10.00 U. S. A.; $15.00 Canada; $12.00 Foreign. Single Numbers $2.00; Special Numbers $4.00. Entered as second class matter August 28, 1926, at the Post Office, New York, N. Y., and on August 28, 1926, at York, Pa., under the act of March 3, 1879. December, 1945—New Series, Volume LXX, No. 3.



FROM AN ORIGINAL ETCHING BY ERNEST D. ROTH

COLLEGE OF PHYSICIANS AND SURGEONS, COLUMBIA UNIVERSITY— Founded in 1767 as the Medical Faculty of Kings College, this institution was the first of its kind in this country to confer the degree of Doctor of Medicine in course. In 1813 it was merged with the independent College of Physicians and Surgeons, which later became a part of Columbia University. Today, this great school together with Presbyterian Hospital and many other famous institutes and clinics, comprises one of the largest and most advanced medical centers in the world.

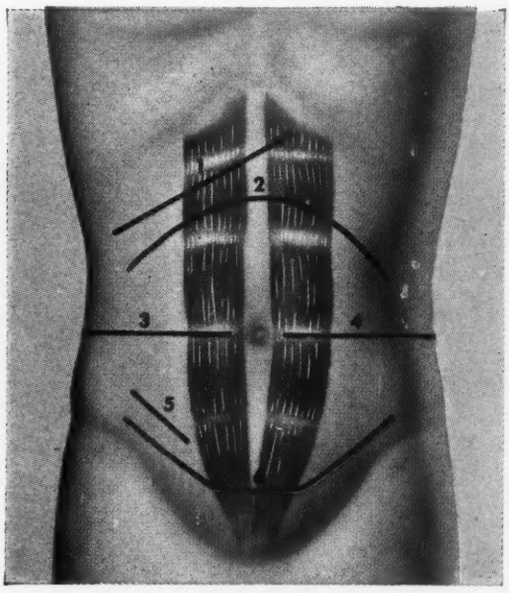
Skill forged in knowledge and sharpened by discipline and constant practice, is the weapon with which surgeons are helping to conquer many of mankinds' worst physical ills. Skill plays a large part, too, in the manufacture of sutures. D&G has perfected its suture making skill and methods through specialization in this one field alone for more than a third of a century, to provide a unique service to the surgical profession.

Incisions that Minimize

INCISIONS which offer maximal assurance against sutures pulling through the tissues eliminate a principal cause of wound disruption.

Sutures hold most securely if the connective tissues within the wound are approximated in such a manner that the sutures must pull against the fibres within these layers. This is possible only when connective tissues are cut parallel to the direction of their fibres. In the anterior abdominal wall, this is usually best accomplished through a transverse initial skin incision.

In suturing transverse incisions, no attempt is made to suture muscle—only the surrounding sheath. Approximation of the muscle edges is further aided by keeping the patient in a semi-reclining position with knees partially flexed.



1. For gall bladder, common duct, head of pancreas.
2. Resection of stomach, transverse colon.
3. Resection of ascending colon, cecum, right sided lesions.
4. Descending colon, spleen and left sided lesions.
5. Appendectomy.
*6. Pelvic surgery, resection of sigmoid.

TRANSVERSE INCISION OF LOWER ABDOMEN

The transverse incision across the lower abdomen provides a wide exposure of the pelvic organs, the rectum, the sigmoid and other pelvic structures. Resections and anastomoses can be performed through it which are not possible through the longitudinal incision.

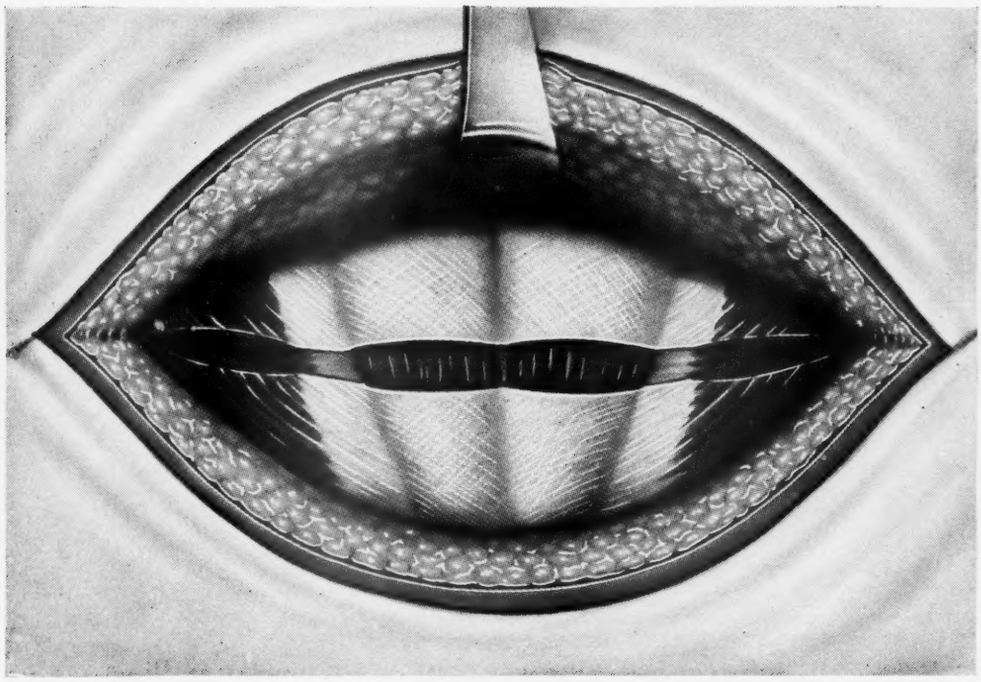
The construction of this incision takes advantage of certain anatomical configurations. These are (1) the thinning and narrowing of the lower ends of the rectus muscle, (2) the termination of the posterior rectus sheath on a level just below the anterior superior spines and (3) the prolongation of the apex of the urinary bladder above this level toward the umbilicus.

MAKING THE INCISION

The skin incision is made completely across the lower abdomen starting from the anterior superior spine on one side, and curving downward, following the crest of the pelvis at a distance of two fingers' breadth, ending at the other anterior superior spine. It is usually made in a flexion crease. The subcutaneous fat and the anterior rectus sheath are incised in the same direction exposing the recti. The muscles are divided close to the symphasis pubis—i.e. through their tendinous portion, leaving stumps only long enough for resuturing. The severed muscles are retracted upwards until the incision in the posterior sheath can be made about one-half inch above the lower edge of this structure or almost directly between the anterior superior spine. When the peritoneum is incised a long prolongation of the bladder

Wound Disruption

NUMBER SIX OF A SERIES

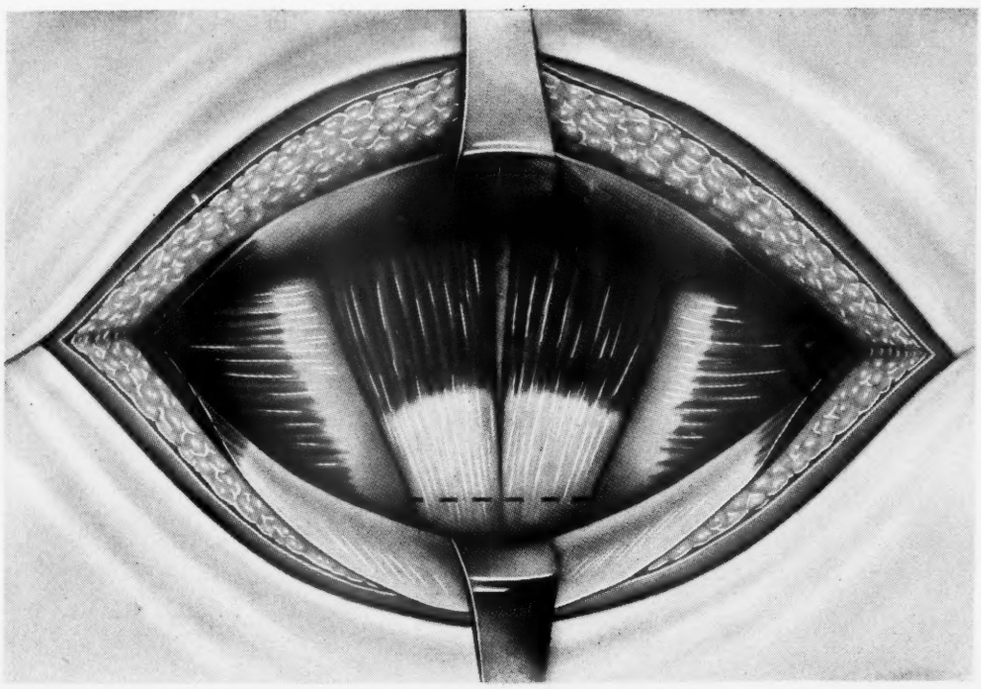


Exposure of external oblique muscles and fasciae.

apex must be watched for. The inferior epigastric arteries are clamped and ligated on either side of the rectus muscle when the posterior sheath is incised.

CLOSING THE INCISION

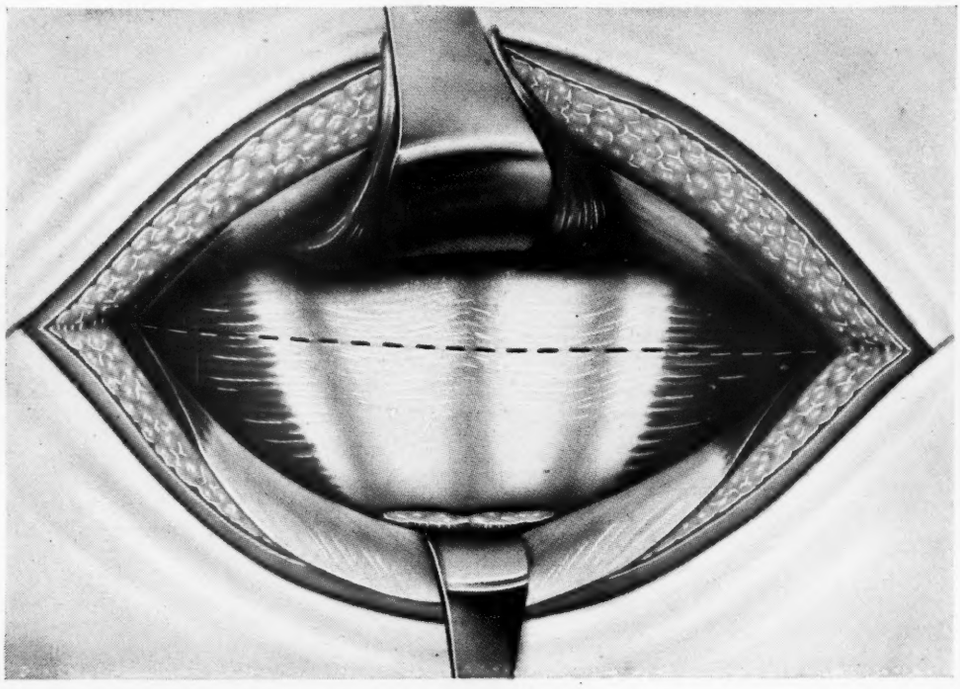
In closing the incision, the posterior sheath is closed with interrupted sutures. The muscles are laid down over this suture line and each is sutured to its stump by two interrupted



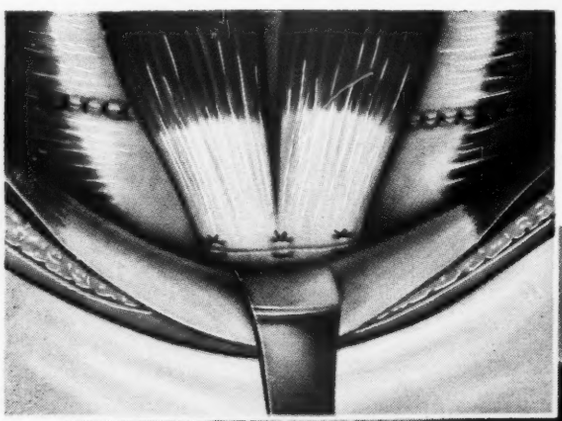
External oblique fascia has been cut transversely and retracted (exposing recti). Incision in recti indicated by dotted line.

Incisions that Minimize Wound Disruption

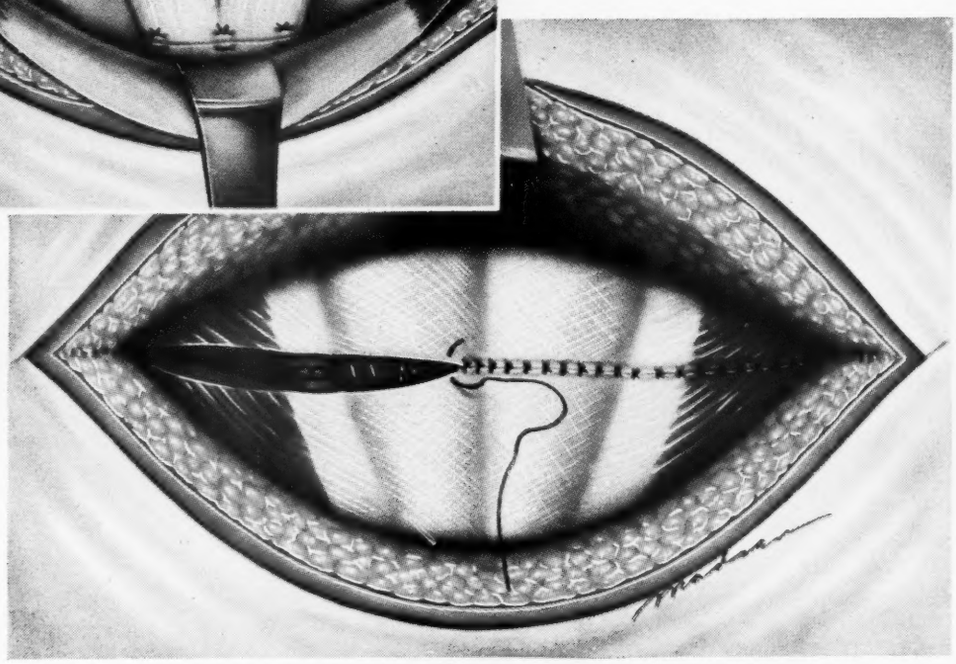
(Continued from Preceding Page)



Recti have been cut in fibrous portion and retracted cephalad. Incision in posterior rectus sheath indicated by dotted line



mattress sutures. The anterior sheath is closed with interrupted sutures and the skin with interrupted skin sutures.



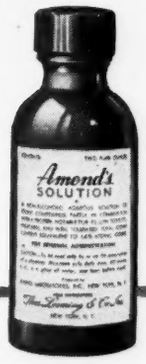
(Above) Suture of posterior sheath completed. Recti sutured.

(Right) Closure of anterior rectus sheath.

DAVIS & GECK, INC.
57 WILLOUGHBY STREET
BROOKLYN 1, NEW YORK

In the Critical Period
AFTER THYROIDECTOMY

A stable, aqueous (1.21%) solution of resublimed iodine, largely in organic form. Contains no glycerin or alcohol. Available on prescription in 2 oz. bottles through all pharmacies.



In the mitigation of the metabolic impact of thyroidectomy it is essential that the iodine administered postoperatively be well tolerated so that therapy can be carried to happy conclusion. When toxic reaction necessitates discontinuation, the patient's condition may become critically grave.

Amend's Solution, virtually non-toxic, has become the iodine medication of choice of many clinicians and surgeons, after as well as before thyroid surgery. It is effective, and dependably SAFE. It is well borne, even immediately after iodides or Lugol's solution had to be withdrawn.

This greater safety of Amend's Solution is due to its unique iodoprotein molecule which releases its iodine gradually, and thus avoids the stormy fluctuation in tissue iodine levels caused by other, more rapidly absorbed iodines.

Thos. Leeming & Co. Inc. • 155 East 44th St., New York 17, N. Y.

Amend's SOLUTION

The American Journal of Surgery

NEW SERIES VOL. LXX — Contents • December, 1945 — NUMBER THREE

Editorial

Conditioned to the Disc . . . . . *Arthur Krida* 275

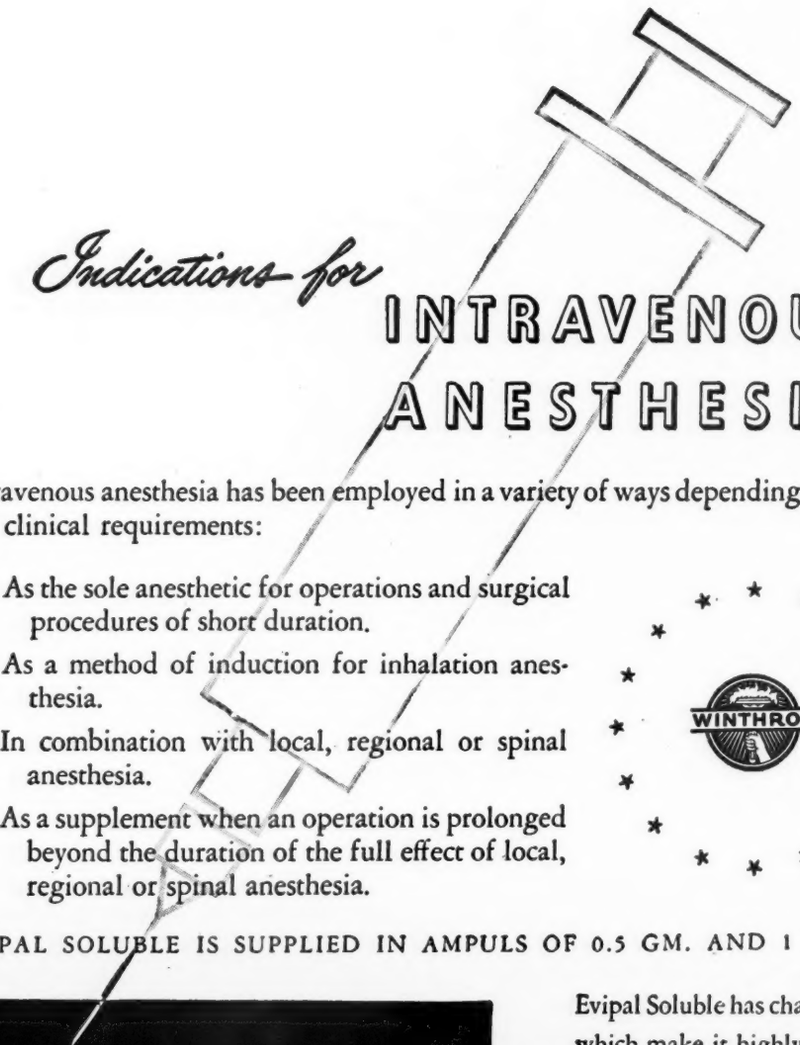
Original Articles

Hemorrhage as the Most Frequent Cause of Maternal Death. An Analysis of the Puerperal Deaths in Brooklyn, 1944 . . . . . *Charles A. Gordon* 277

Intravenous Obstetrical Anesthesia. Preliminary Report . . . . . *Frederick M. Allen* 283

Surgical Management of Femoral Vein Thrombosis . . . . . *Eugene L. Lowenberg* 291

Contents Continued on Page 3



Indications for

INTRAVENOUS ANESTHESIA

Intravenous anesthesia has been employed in a variety of ways depending upon the clinical requirements:

1. As the sole anesthetic for operations and surgical procedures of short duration.
2. As a method of induction for inhalation anesthesia.
3. In combination with local, regional or spinal anesthesia.
4. As a supplement when an operation is prolonged beyond the duration of the full effect of local, regional or spinal anesthesia.

WINTHROP

EVIPAL SOLUBLE IS SUPPLIED IN AMPULS OF 0.5 GM. AND 1 GM.

EVIPAL SOLUBLE

"Evipal" Reg. U. S. Pat. Off. & Canada

Brand of HEXOBARBITAL SOLUBLE

(Sodium salt of N-methylcyclohexenylmethyl barbituric acid)

ACCEPTED AMERICAN MEDICAL ASSN. Council on Pharmacy and Chemistry

Evipal Soluble has characteristics which make it highly useful for inducing these various types of anesthesia of short duration. Proper dosage gives deep relaxation of voluntary muscles, yet quick awakening and recovery, generally after twenty or thirty minutes.

WINTHROP CHEMICAL COMPANY, INC.

PHARMACEUTICALS OF MERIT FOR THE PHYSICIAN

New York 13, N. Y • Windsor, Ont.

The American Journal of Surgery

Reg. U. S. Pat. Off., Nov. 3, 1936

NEW SERIES VOL. LXX — NUMBER THREE

Contents • December, 1945

Simplification of Split Skin Grafting. Gum Acacia Technic . . . . *Captain Leonard R. Rubin* 302

Control of the Thyroid Storm . . . . . *Captain Irwin Schimmel* 308

Experimental Transmission of Lymphogranuloma Venereum Virus through the Placenta . . . . . *Hugo Hellendall* 320

Use of Thrombin (Topical) in Transurethral Resection of the Prostate . . . . . *Clarence G. Bandler, Philip R. Roen and Raymond Stept* 337

Urinary Stress Incontinence in the Female. A Combined Gyno-urological Approach to Its Correction . . . . . *Walter J. Reich, J. Lester Wilkey and Harold E. Silverman* 341

Phthalylsulfathiazole-'Sulfathalidine.' A Clinical Evaluation in 122 Patients with Proctologic and Related Conditions . . . . . *Gaspar Angelo* 354

A Method of Treatment for Pilonidal Sinus . . . . . *Jacob K. Berman* 360

Refrigeration Anesthesia . . . . . *Dermont W. Melick* 364

Treatment of Intertrochanteric Fractures of the Femur. The Use of the Hanging Cast . . . . . *Capt. Joseph L. Posch and William E. Abbott* 369

Newer Postoperative Trends . . . . . *DeWitt C. Daughtry* 374

Bicipital Tendovaginitis . . . . . *Major I. W. Kaplan and Major B. L. Hawkins* 383

Case Reports

Acute Suppurative Appendicitis with Abscess Formation and Subsequent Perforation of the Anterior Abdominal Wall . . . . . *Louis J. Gariepy and Paul G. Henley* 386

Polyps of the Appendix . . . . . *Lieut. Col. J. William White and Major Ralph C. Ellis* 389

Benign Tumors of the Duodenum . . . . . *Burton P. Hoffman and David M. Grayzel* 394

Mixed Bacterial Gangrene of an Extremity Treated with Penicillin and Sulfadiazine . . . . . *Bernard N. E. Cohn and Emanuel Friedman* 401

Surgical Aspects of Certain Blood Dyscrasias . . *Damon B. Pfeiffer and F. M. Simmons Patterson* 408

Primary Repair of the Parotid Duct . . . . . *F. T. Wallace* 412

Selected Book Reviews 414

Author Index to Volume LXX 419

Subject Index to Volume LXX 420

General Information on Page 4 *Advertising Index on 3rd cover*

General Information

THE AMERICAN JOURNAL OF SURGERY does not hold itself responsible for any statements made or opinions expressed by any contributor in any article published in its columns.

Articles are accepted for publication with the understanding that they are original contributions never previously published. All manuscripts are subject to editorial modification, and upon acceptance become the property of THE AMERICAN JOURNAL OF SURGERY, INC.

A reasonable number of illustrations are supplied free of cost; special arrangements must be made with the editor and publishers for excess illustrations and elaborate tables.

Reprints are furnished on order. Prices are quoted when articles are in page form.

Material published in THE AMERICAN JOURNAL OF SURGERY is copyrighted and may not be reproduced without permission of the publishers.

Change of address must reach us by the 15th of the month preceding month of issue.

PREPARATION OF MANUSCRIPTS

Text. Manuscripts are to be typewritten, on one side of the paper, with double spacing and good margins. The original should be sent to the editor and a carbon copy retained by the author.

Illustrations. Illustrations must be in the form of glossy prints or drawings in black ink (*never* in blue). On the back of each illustration the figure number, author's name and an indication of the top of the picture should be given. Legends for illustrations are to be typewritten in a single list, with numbers corresponding to those on the photographs and drawings. Please do not attach legends to the pictures themselves.

Bibliographies. Bibliographic references should be at the end of the manuscript, in alphabetical order, and not in footnotes. Each reference should include the following information in the order indicated: Name of author with initials; title of article; name of periodical; volume, page and year. The following may be used as a model:

PHANEUF, LOUIS E. Indications and technique. *Am. J. Surg.*, 25: 446, 1937.

The author should always place his full address on his manuscript.

The subscription price of THE AMERICAN JOURNAL OF SURGERY, is $10.00 per year in advance in the United States; $15.00 in Canada; and $12.00 in foreign countries. Current single numbers $2.00. All Special Numbers $4.00. Prices for such back numbers as are available will be quoted on request.

Address all correspondence to

The American Journal of Surgery

49 WEST 45TH STREET · NEW YORK 19

FOR *ORAL* PENICILLIN THERAPY

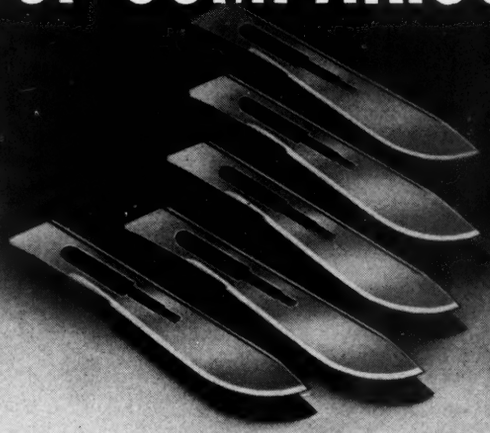
Per-Os-Cillin tablets—a notable contribution to modern penicillin therapy—contain penicillin calcium combined with special long-acting buffers which effectively protect penicillin from the destructive action of gastric acid. The tablets are stable, promptly absorbed and conveniently taken. Per-Os-Cillin is recommended for the treatment of gonorrhea and for maintenance therapy in pneumococcic, streptococcic and staphylococcic infections. *Per-Os-Cillin tablets, 25,000 units each, are available in tubes of 12.

* For approved uses of oral penicillin see C. S. Keefer, et al., J.A.M.A., 128:1161, 1945

HOFFMANN-LA ROCHE, INC., ROCHE PARK, NUTLEY 10, N. J.

YARDSTICK OF COMPARISON

...RIB-BACK BLADES



As manufacturers of what are widely regarded as the finest surgical blades ever developed, it is our conviction that professional preference is based upon their actual performance rather than attempts to evaluate their qualities by mechanical determinations.

Surgeons *feel* the superior sharpness of their inimitable cutting edges.

Surgeons *sense* just the desired degree of rigidity necessary to resist lateral pressure.

Surgeons *know* that dependable strength and long cutting efficiency serves to reduce blade consumption to a minimum.

★ The quality of Rib-Back Blades has suffered no wartime change. Precision uniformity . . . blade for blade . . . and long periods of satisfactory service, make them the least expensive in the final cost analysis.

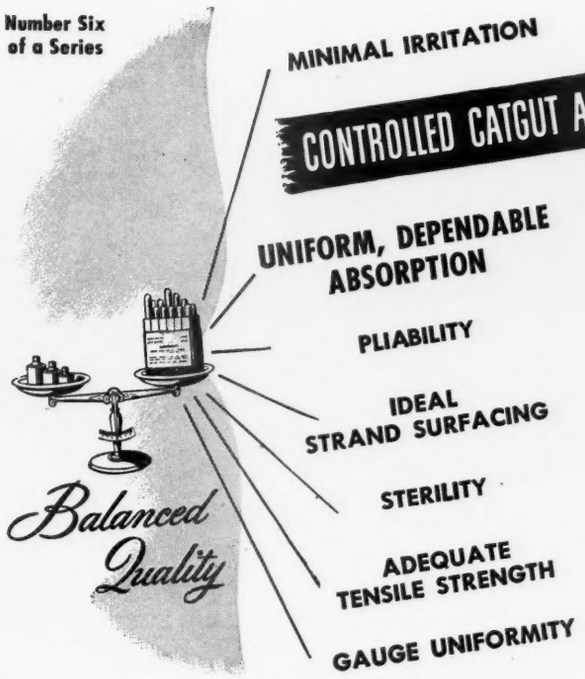
Ask your dealer

BARD-PARKER COMPANY, INC.

Danbury, Connecticut

A BARD-PARKER PRODUCT

Number Six
of a Series



CONTROLLED CATGUT ABSORPTION...*Greater Functional Strength*

2400 representative tests summarized in the graph on this page give new evidence of greater functional strength—an important contributing factor in the uniform, dependable absorption of Curity Catgut.

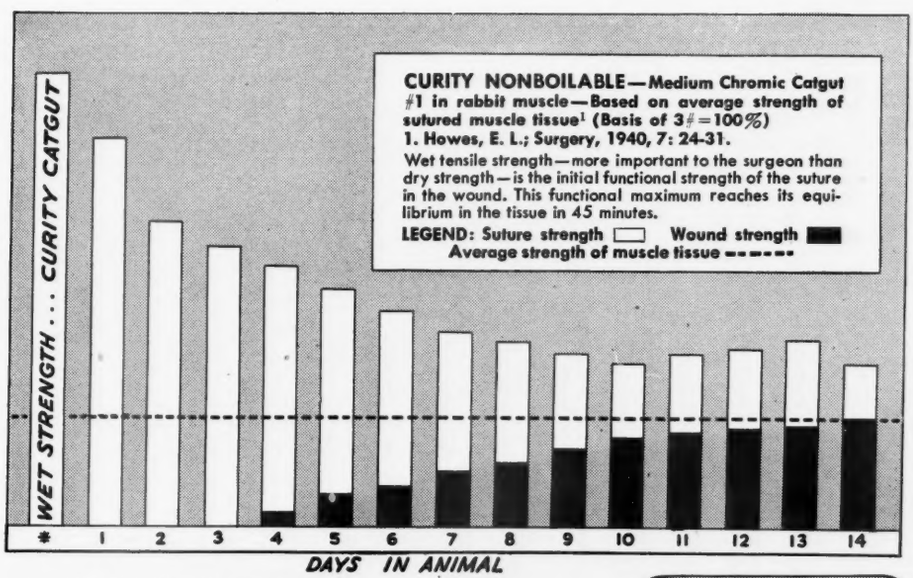
A predictable rate of *foreign body elimination* has been demonstrated previously by Curity Suture Laboratories with photomicrographs of tissue implantations showing the successive stages of absorption.

Now another essential factor in catgut absorption is established.

Thousands of animal experiments—averaged in the graph below—unmistakably attest the fact that, during the orderly progress of absorption, Curity Catgut retains *more than adequate functional strength.*

★ ★ ★

In addition to uniform, dependable absorption, weighted excellence in all other important characteristics is built into Curity Catgut. Thus Balanced Quality is maintained.


CURITY NONBOILABLE—Medium Chromic Catgut #1 in rabbit muscle—Based on average strength of sutured muscle tissue[1] (Basis of 3# = 100%)
1. Howes, E. L.; Surgery, 1940, 7: 24-31.
Wet tensile strength—more important to the surgeon than dry strength—is the initial functional strength of the suture in the wound. This functional maximum reaches its equilibrium in the tissue in 45 minutes.
LEGEND: Suture strength Wound strength
Average strength of muscle tissue
WET STRENGTH . . . CURITY CATGUT
* 1 2 3 4 5 6 7 8 9 10 11 12 13 14
DAYS IN ANIMAL

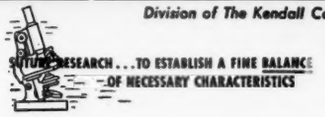
* 45 MINUTES AFTER IMPLANTATION

Curity Suture Laboratories

BAUER & BLACK

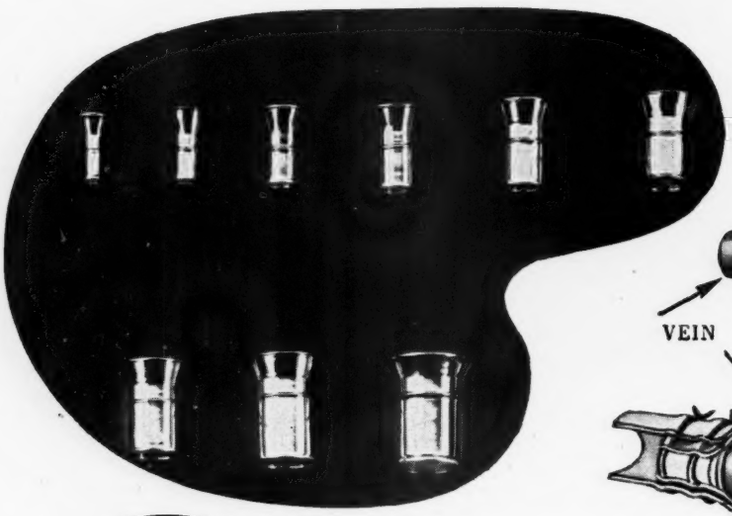
Division of The Kendall Company, Chicago 16

Curity
REG. U.S. PAT. OFF.
SUTURES

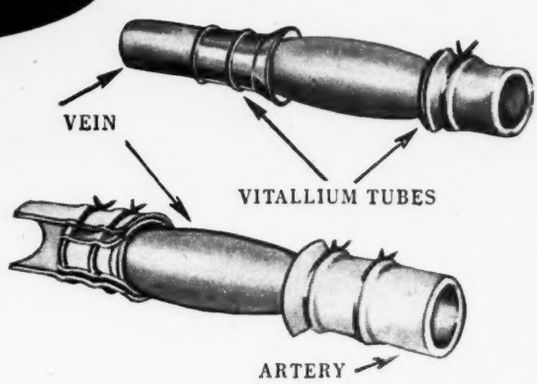


VITALLIUM TUBES

For Non-Suture Blood Vessel Anastomosis



Blakemore-Lord TYPE



MICROCAST TECHNIQUE
VITALLIUM

TRADE MARK REG.
U. S. PAT. OFF.

ORDER FROM YOUR DEALER

ACUTE traumatic extremity wounds with main artery damage are a real challenge. Amputation can frequently be avoided if adequate blood supply can be maintained.

Elective surgery for the alleviation or correction of numerous circulatory conditions, such as aneurysms, fistulae and portal hypertension shows renewed promise with the use of Vitallium tubes.

Studies concerning Vitallium as a non-irritating alloy for blood vessel anastomosis are continuing, and authentic case reports are being added to surgical literature.

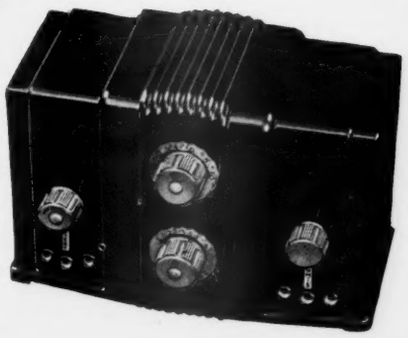
One more example of the usefulness of Vitallium in surgery.

*THE SEVERED PRIMARY ARTERY IN THE WAR WOUNDED, Blakemore, A. H., Lord, J. W., Jr., & Stefko, P. L. Surgery, 12-3 Sept. 1942
*RESTORATION OF BLOOD FLOW IN DAMAGED ARTERIES, Blakemore, A. H., Lord, J. W., Jr., & Stefko, P. L. Ann. Surg. 117-4 Apr. 1943
*A NONSUTURE METHOD OF BLOOD VESSEL ANASTOMOSIS: EXPERIMENTAL AND CLINICAL STUDY
Blakemore, A. H., & Lord, J. W., Jr. Jour. Amer. Med. Assn. 127-12 & 13 Mar. 24 & 31, 1945
A NONSUTURE METHOD OF BLOOD VESSEL ANASTOMOSIS, Blakemore, A. H., & Lord, J. W., Jr. Ann. Surg. 121-4 Apr. 1945
*THE TECHNIQUE OF USING VITALLIUM TUBES IN ESTABLISHING PORTACAVAL SHUNTS FOR PORTAL HYPERTENSION
Blakemore, A. H., & Lord, J. W., Jr. Ann. Surg. 122-4 Oct. 1945

*Reprints available upon request.

NEW YORK **AUSTENAL LABORATORIES, INC.** CHICAGO

WAPPLER
Major Cautery



Catalogue No. C 200

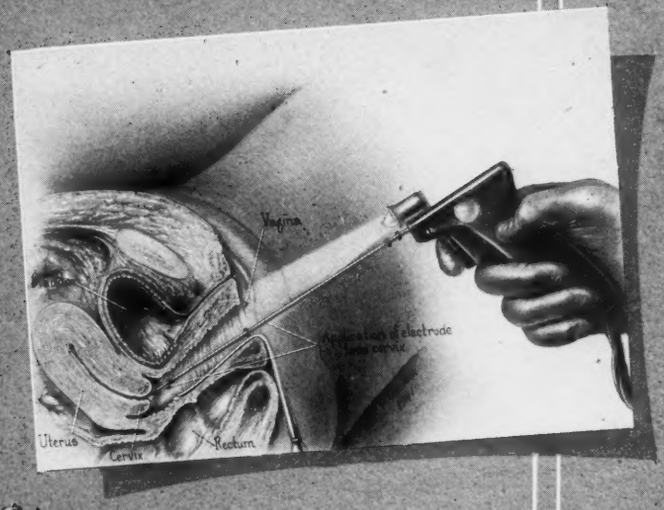
Write for Literature

One is immediately impressed with the handsome, dignified appearance of this Wappler Major Cautery and Light Transformer. Housed in a lustrous molded case with a contrasting color for the controls, this beautifully designed instrument will enhance any doctor's office equipment.

Whenever the use of thermal cautery is indicated, the Wappler Major Cautery is the choice of doctors everywhere. It has ample power for all cauterization procedures and its added exclusive Wappler convenience features account for its wide acceptance by the medical profession. Two ranges of diagnostic light current are available. Separate light controls are provided for both cautery and light regulation that provides a nicety of control which greatly facilitates the work in hand. The Wappler mono-plug connection outmodes all other cauteries. The comfortable pistol-grip handle fits the hand naturally. The pistol-grip handle, exclusive with Wappler, cannot heat, is light in weight, nicely balanced and can be sterilized by boiling. The convenient trigger switch controls the heating of cautery tips. The built-in spotlight is so located that the electrode casts no shadow into the brilliantly lighted operative field.

7
Points of Superiority

- ☆ *Striking Appearance*
- ☆ *Dependable*
- ☆ *Mono-Plug Connection*
- ☆ *Precise Light Control*
- ☆ *Built-in Spotlight*
- ☆ *Balanced Pistol-Grip Handle*
- ☆ *Trigger Switch Control*



Established 1900 by *Reinhold H. Wappler*

AMERICAN CYSTOSCOPE MAKERS, Inc.

Frederick C. Wappler, President

1241 LAFAYETTE AVENUE, NEW YORK, N. Y.

For buried suturing CHAMPION-PARÉ Serum-Proof Silk Sutures offer these advantages:

- Non-absorbable
- Non-irritating
- Gentle to tissue
- Minimize possibility of infection
- Reduce suppuration
- Great tensile strength permits use of smaller diameters, thus reducing tissue trauma
- Soft and supple—easy to handle
- Braided to insure uniform strength
- Moisture-proof

Champion-Paré *Serum-Proof* Silk Sutures are made of the finest quality silk, by the exclusive Gudebrod process. They bear both the name *and reputation* of this long-established institution, whose products have been acclaimed for many years by the leading surgeons of the world. Free operating lengths of Champion-Paré *Serum-Proof* Silk Sutures will be sent upon request.

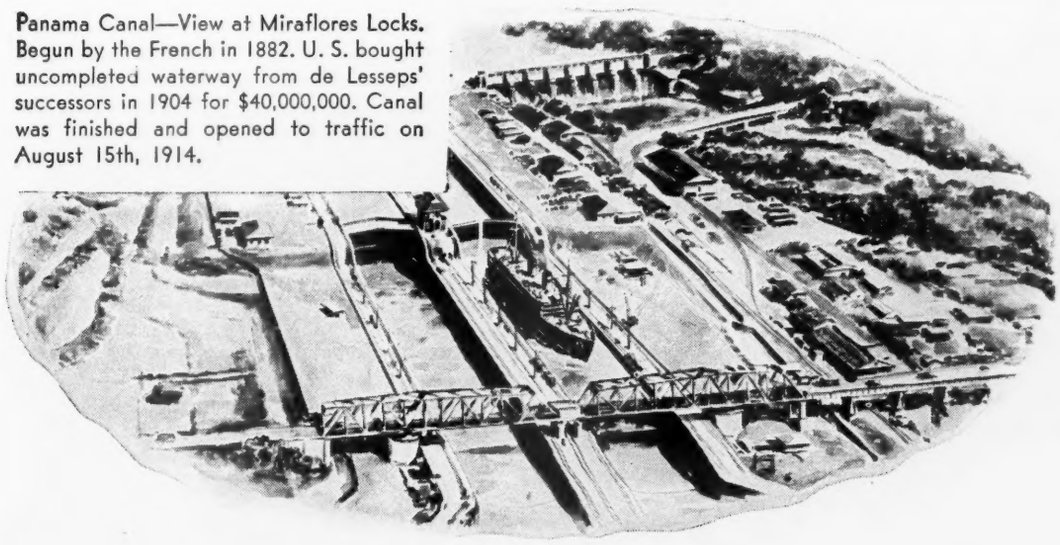
CHAMPION-PARÉ SILK SUTURES

GUDEBROD BROTHERS SILK CO., INC.
12 SOUTH 12th STREET, PHILADELPHIA 7, PA.
NEW YORK • BOSTON • LOS ANGELES • CHICAGO

GUDEBROD BROS. CHAMPION

MANY SURGEONS NOW PREFER THE MINTRAUMATIC SUTURE—NEEDLE SWAGED TO END OF A SINGLE STRAND. WRITE FOR INFORMATION

Panama Canal—View at Miraflores Locks. Begun by the French in 1882. U. S. bought uncompleted waterway from de Lesseps' successors in 1904 for $40,000,000. Canal was finished and opened to traffic on August 15th, 1914.



PERFECTION

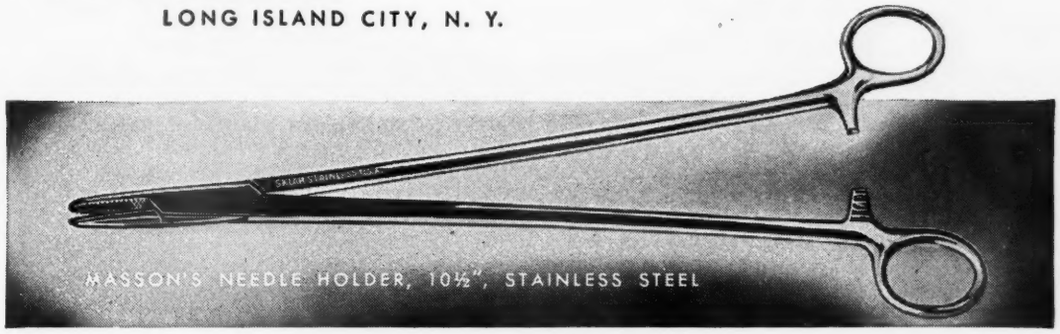
in its field...

PANAMA CANAL—generally considered one of the greatest engineering feats of all time. Just as the Canal has been of inestimable benefit to our country in peace and war, so too, have SKLAR instruments been of incalculable value to the surgeons of our nation in peace and war. SKLAR, for more than fifty years, has maintained a standard of excellence in the manufacturing of all of its products, which has never been surpassed. SKLAR instruments are tough, durable and dependable under strain. SKLAR research and engineering is continuously anticipating surgical trends and needs. Devotion to detail and long range planning have made the J. SKLAR MANUFACTURING COMPANY the leader in the highly specialized industry of surgical instrument manufacturing. *All SKLAR products are sold only through accredited surgical supply distributors.*

Sklar

LONG ISLAND CITY, N. Y.

A catalog of SKLAR STAINLESS STEEL Instruments will be provided on request.



MASSON'S NEEDLE HOLDER, 10½", STAINLESS STEEL

These Three B-D Steritubes

protect your sterilized instruments

SAVE MONEY and TIME

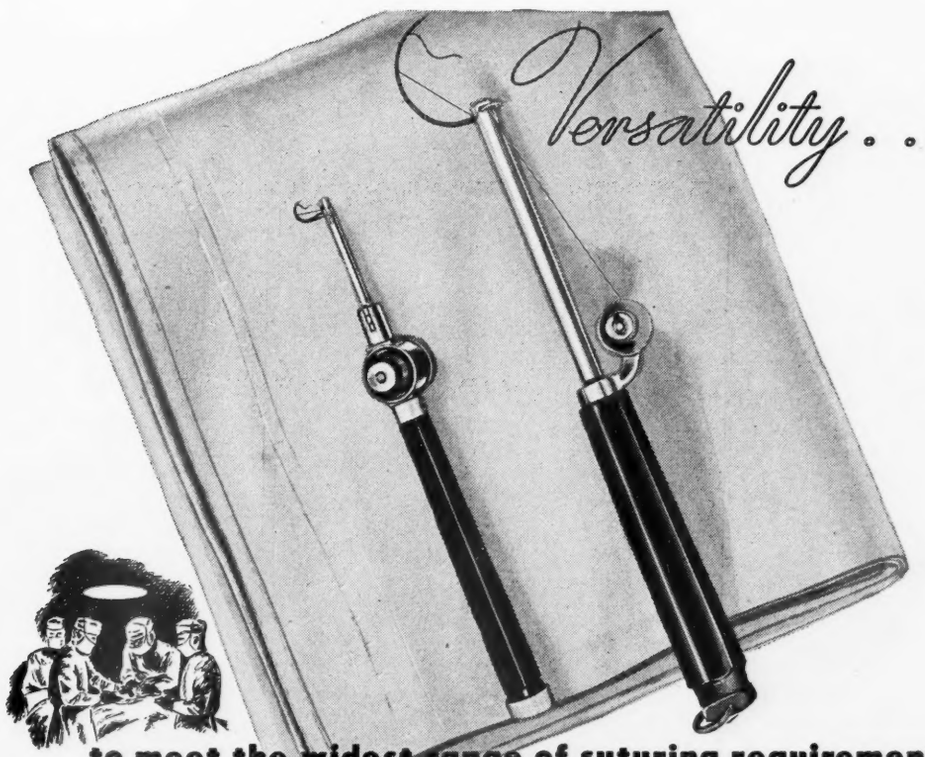
No. 17
FEVER THERMOMETER STERITUBE
Durable glass case carries thermometer in sterilizing solution, cushioned from shock by stainless steel ejector spring. Metal cap fits snugly on ground luer tip to prevent leakage.

No. 300
SYRINGE STERITUBE
Boilable metal holder carries sterile syringe and needle ready for instant use—in home or office. Rubber cap and washer cushion syringe from shock and withstand sterilization. Suspension of needle point prevents damage.

No. 400
NEEDLE STERITUBE
Keeps sterile needles ready for use. Glass permits sterile inspection of protected points, gauge and size. Flared glass rims and gripping rubber caps insure continued sterility. All parts boilable.

B-D PRODUCTS
Made for the Profession

BECTON, DICKINSON & CO., RUTHERFORD, N. J.



Versatility . . .

to meet the widest range of suturing requirements

In surgical procedures . . . Because the Singer Surgical Stitching Instrument efficiently employs such a wide variety of different types and sizes of needles, it provides almost unlimited suturing versatility. Two convenient sizes of instrument—the "Standard," and the smaller "A-11 Model"—enable the surgeon to handle every suturing problem with satisfaction—particularly since the instrument need never leave his hand during the entire suturing phase.

In stitching formation . . . The Singer Surgical Stitching Instrument permits faster and easier placement of the precise stitch required—by making practicable the utilization of a far *wider variety* of stitch formations. It utilizes almost *any suturing material* (fed from a continuous spool supply).

A fully illustrated brochure tells the whole story. Use the coupon below for your copy.

47 SINGER NEEDLE SIZES
of various types from large to small
The wide variety of needle sizes and styles available for use with the Singer suturing instrument afford a major advantage to the meticulous surgeon who insists on the right needle for the right job.

SINGER SURGICAL STITCHING INSTRUMENT

—unites needle, holder, suture supply and severing edge in one self-contained instrument

Copyright, U.S.A., 1945 by the Singer Manufacturing Company. All Rights Reserved for all Countries.

SINGER SEWING MACHINE COMPANY
Surgical Stitching Instrument Division
149 Broadway, New York 6, N. Y. A-125

Without obligation please send copy of illustrated brochure.

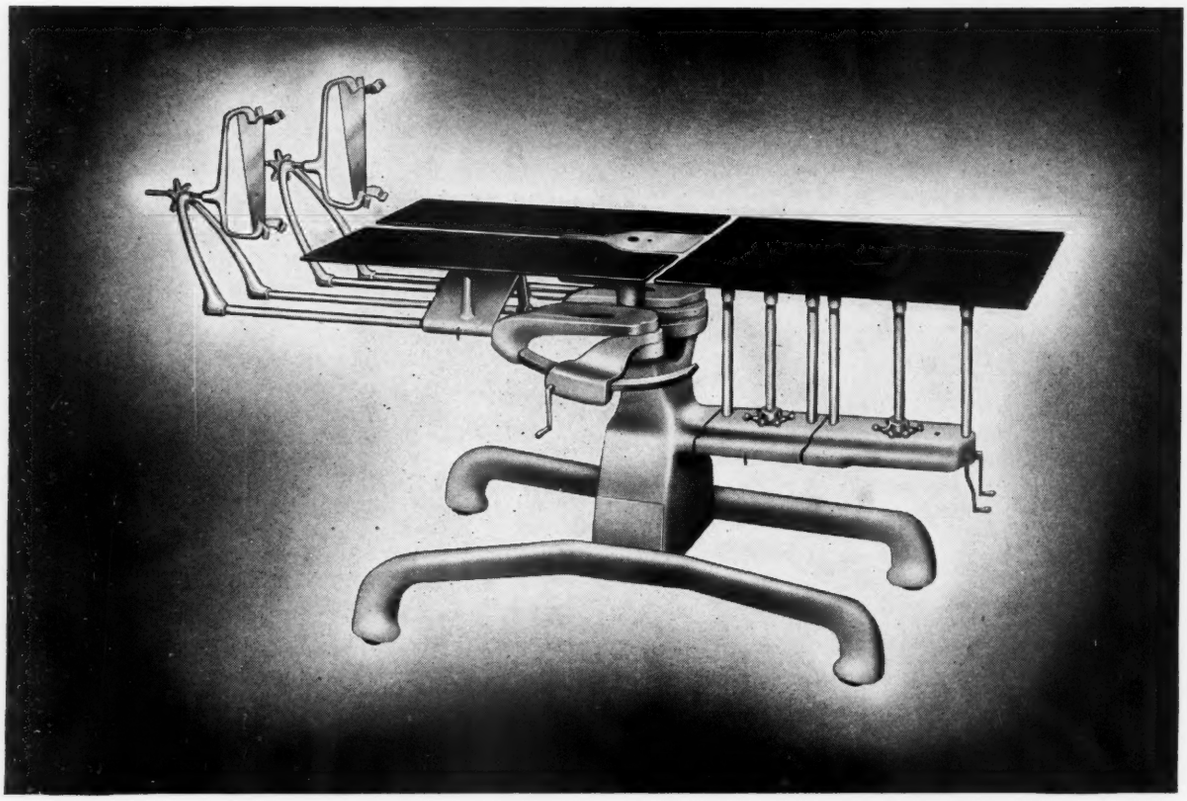
NAME_____

ADDRESS_____

CITY_____ _____ STATE_____

Presenting

THE NEW
ROGER ANDERSON FRACTURE TABLE



Designed for Efficiency

THIS light strong aluminum table provides for all fracture, orthopedic and surgical procedures: hip nailing, skeletal and all other types of traction including vertical, transverse and longitudinal spinal traction, hyperextension of spine, and application of all casts. The addition of a mattress converts it into a general surgical table.

Leg traction frames operate independently of each other, supplying flexion, extension, abduction, adduction and ROTATION ALL UPON ANATOMICAL CENTERS. They also swing apart to permit placement of X-ray machine, and to allow assistant to stand between the legs while operating.

ADDITIONAL FEATURES. Positioning in the true and reverse Trendelenburg, a transparent plastic perineal post, the adjustable foot straps, special cassette holder for hip radiography, and unique head, face and shoulder supports.

Write for illustrated folder. Place your order NOW to insure that your hospital will be among the first to be supplied.

THE TOWER COMPANY, INC.

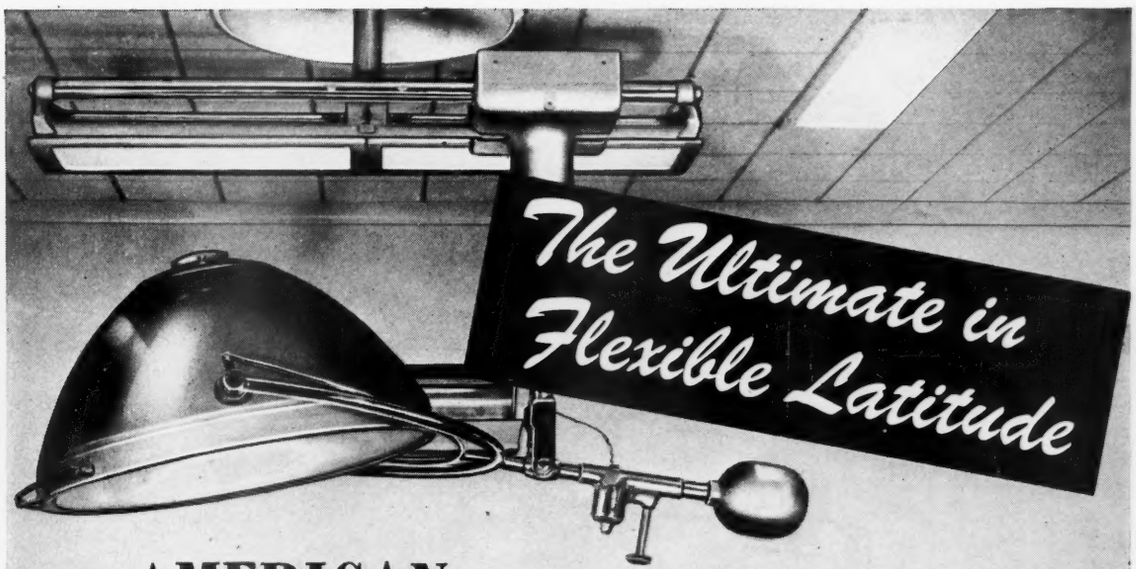
Manufacturing and Research Specialists in Fracture and Surgical Equipment
Home Office: 1008 Western Avenue, Seattle 4, Wash.—MAin 4443

TOWER

Representatives:
120 South La Salle Street
Chicago 3, Ill.
Phone: State 8456

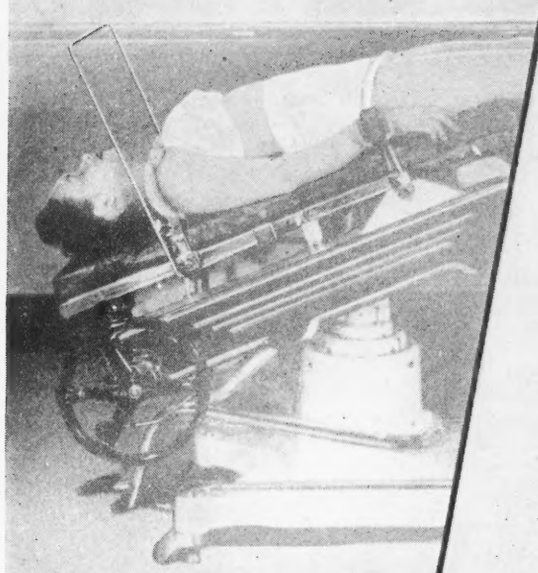
SURGICAL DISTRIBUTORS, INC.
1681 University Avenue
St. Paul 4, Minn.
Phone: NEstor 5872

38 Park Row
New York 7, N. Y.
Phone: BArclay 7-6492



THE AMERICAN MAJOR SURGICAL LUMINAIRE (Model DMC)

This distinctive 34″ model provides for complete flexibility of illumination in any plane—vertical or horizontal—over any operative area.



These highlights are equally important

- Featuring a combination non-rotating type track and offset counterbalanced construction, it is readily positioned by a dual control which voids any need to reach into the sterile field.
- The three intensities of illumination afforded will normally compensate for variables in strength of vision of all surgeons.

Specify AMERICAN

A complete line of MAJOR and MINOR SURGICAL LIGHTS . . . ceiling suspended and portable types.

WRITE TODAY for descriptive literature

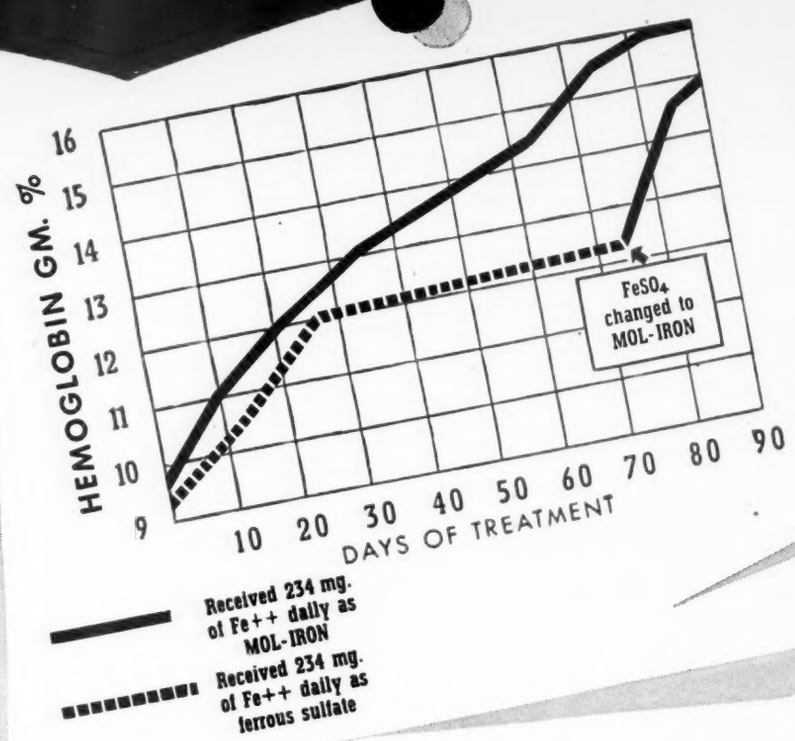
AMERICAN STERILIZER COMPANY

Erie, Pennsylvania

DESIGNERS AND MANUFACTURERS OF SURGICAL STERILIZERS, TABLES AND LIGHTS

a new and definite advance

IN TREATING IRON-DEFICIENCY ANEMIAS



The therapeutically superior effect of Mol-Iron is well demonstrated in the above graph which illustrates the comparative rate of hemoglobin regeneration, in response to treatment with Mol-Iron and ferrous sulfate, in two pregnant women having approximately the same degree of iron-deficiency anemia. This response is typical of that observed in an evaluation of Mol-Iron in a series of pregnant women with hypochromic anemia.

A specially processed, co-precipitated complex of molybdenum oxide (3 mg.) and ferrous sulfate (195 mg.).

White's MOL-IRON TABLETS

Available clinical evidence indicates that, in hypochromic anemia, the therapeutic response to this highly effective synergistic combination — as compared with equivalent dosage of ferrous sulfate alone — has unusual advantages:

1) **NORMAL HEMOGLOBIN VALUES ARE RESTORED MORE RAPIDLY, INCREASES IN THE RATE OF HEMOGLOBIN FORMATION BEING AS GREAT AS 100% OR MORE IN PATIENTS STUDIED.**

2) **IRON UTILIZATION IS SIMILARLY MORE COMPLETE.**

3) **GASTRO-INTESTINAL TOLERANCE IS NOTABLY SATISFACTORY—even among patients who have previously shown marked gastro-intestinal reactions following oral administration of other iron preparations.**

Indicated in: Hypochromic (iron-deficiency) anemias caused by inadequate dietary intake or impaired intestinal absorption of iron; excessive utilization of iron, as in pregnancy and lactation; chronic hemorrhage.

Dosage: One or two tablets three times daily after meals.

Available in bottles of 100 and 1000 tablets. Ethically promoted — not advertised to the laity.

PHARMACEUTICAL White MANUFACTURERS
LABORATORIES, INC.
NEWARK 2, N. J.

Those we Love

Their bright young faces . . . sons, daughters, grandchildren . . . smiling at him from his desk, are treasured in his heart. His own success is more important because it makes their pathway fair and wide.

To that end the surgeon devotes his best efforts ...demands the best professional equipment that science and industry can provide.

Meeting the most exacting demands for precision and ease of control, the dependable Birtcher-Built Electrosurgical Unit excels in such technics as trans-urethral prostatic resections.

The* BIRTCHER *Corporation

5087 HUNTINGTON DRIVE • LOS ANGELES 32

THE BIRTCHER CORP., Dept. N 12-5
Los Angeles 32

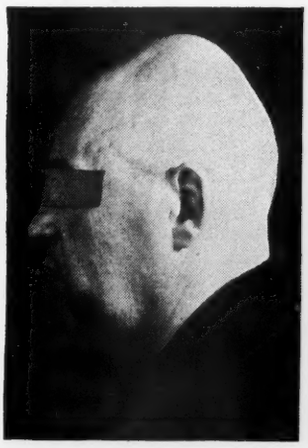
Send me free brochure
"ELECTROSURGERY."

NAME _____

ADDRESS _____

CITY _____ ZONE _____ STATE _____

Skull repair with Tantalum implant



Lateral view of patient before operation for insertion of tantalum implant.

Lateral view of patient after operation.

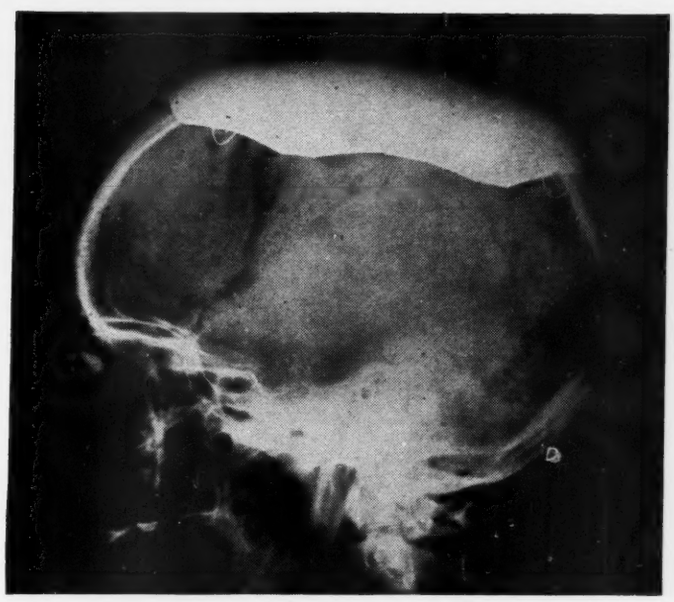
"THE importance of the repair of defects of the skull has not been sufficiently stressed in the past," says W. James Gardner, of the Cleveland Clinic.†

"A sheet of tantalum," says Dr. Gardner, "constitutes an almost ideal material for the repair of cranial defects. It should be more widely employed for the immediate repair of compound fractures of the skull."

* * *

• For skull repair, tantalum is supplied in sheets, wire, and sutures. Literature on request.

† Gardner, W. James, M. D., F. A. C. S., "Closure of Defects of the Skull with Tantalum," S. G. & O., 80: 303, March, 1945.



Postoperative roentgenogram of patient shown above.

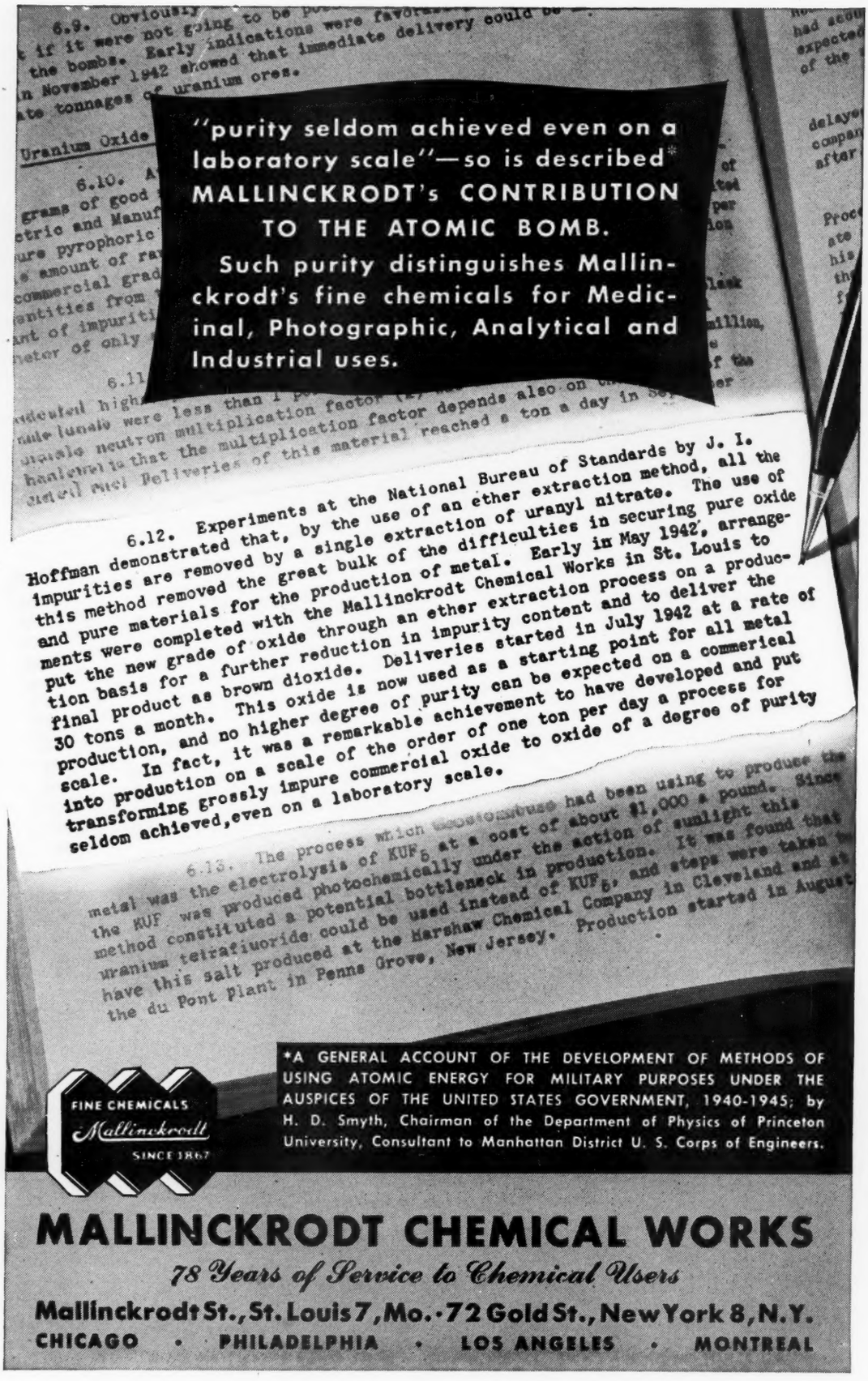
Tantalum is now available through surgical dealers

ETHICON
Sutures

For Every Surgical Procedure

ETHICON SUTURE LABORATORIES

DIVISION OF JOHNSON & JOHNSON, NEW BRUNSWICK, N. J.


"purity seldom achieved even on a laboratory scale"—so is described* MALLINCKRODT's CONTRIBUTION TO THE ATOMIC BOMB.
Such purity distinguishes Mallinckrodt's fine chemicals for Medicinal, Photographic, Analytical and Industrial uses.
6.12. Experiments at the National Bureau of Standards by J. I. Hoffman demonstrated that, by the use of an ether extraction method, all the impurities are removed by a single extraction of uranyl nitrate. The use of this method removed the great bulk of the difficulties in securing pure oxide and pure materials for the production of metal. Early in May 1942, arrangements were completed with the Mallinckrodt Chemical Works in St. Louis to put the new grade of oxide through an ether extraction process on a production basis for a further reduction in impurity content and to deliver the final product as brown dioxide. Deliveries started in July 1942 at a rate of 30 tons a month. This oxide is now used as a starting point for all metal production, and no higher degree of purity can be expected on a commerical scale. In fact, it was a remarkable achievement to have developed and put into production on a scale of the order of one ton per day a process for transforming grossly impure commercial oxide to oxide of a degree of purity seldom achieved, even on a laboratory scale.
6.13. The process which Mallinckrodt had been using to produce the metal was the electrolysis of KUF5 at a cost of about $1,000 a pound. Since the KUF5 was produced photochemically under the action of sunlight this method constituted a potential bottleneck in production. It was found that uranium tetrafluoride could be used instead of KUF5, and steps were taken to have this salt produced at the Harshaw Chemical Company in Cleveland and at the du Pont Plant in Penns Grove, New Jersey. Production started in August
*A GENERAL ACCOUNT OF THE DEVELOPMENT OF METHODS OF USING ATOMIC ENERGY FOR MILITARY PURPOSES UNDER THE AUSPICES OF THE UNITED STATES GOVERNMENT, 1940-1945; by H. D. Smyth, Chairman of the Department of Physics of Princeton University, Consultant to Manhattan District U. S. Corps of Engineers.
FINE CHEMICALS
Mallinckrodt
SINCE 1867
MALLINCKRODT CHEMICAL WORKS
78 Years of Service to Chemical Users
Mallinckrodt St., St. Louis 7, Mo. · 72 Gold St., New York 8, N.Y.
CHICAGO · PHILADELPHIA · LOS ANGELES · MONTREAL

Closure of Colostomy — Extraperitoneal

In performing major surgery, such as extraperitoneal closure of a colostomy, the surgeon must have assurance that the materials at his command are of the very best quality. The suture he needs must be the pinnacle in surgical gut. Armour's sutures can be depended on to meet this demand. The surgeon has confidence in their tensile strength—uniformity—sterility—and their pliable texture. Ligating is done readily with Armour's sutures—the knots are firm and secure. To those surgeons who are not familiar with Armour's sutures, The Armour Laboratories will supply samples on request.

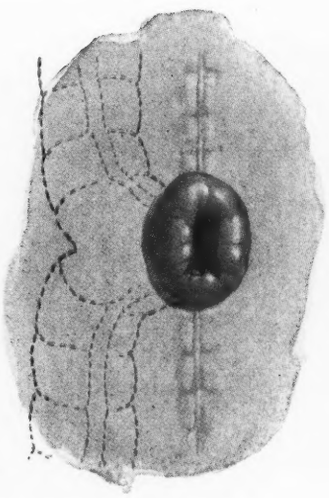
Good surgery demands the best of suture materials—specify ARMOUR sutures and ligatures

THE ARMOUR LABORATORIES • CHICAGO 9, ILLINOIS

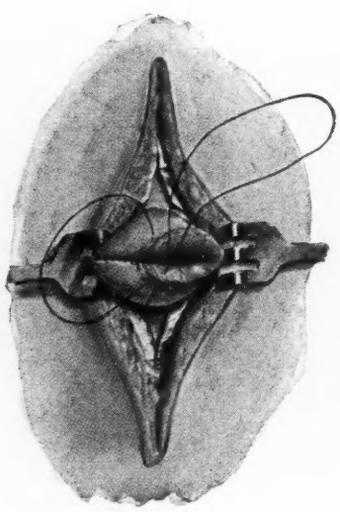
Obstructive Resection *for* Sigmoid Carcinoma

PART II.

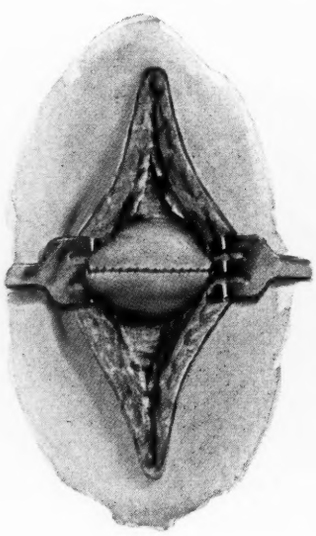
Closure of Sigmoid Colostomy—Extraperitoneal



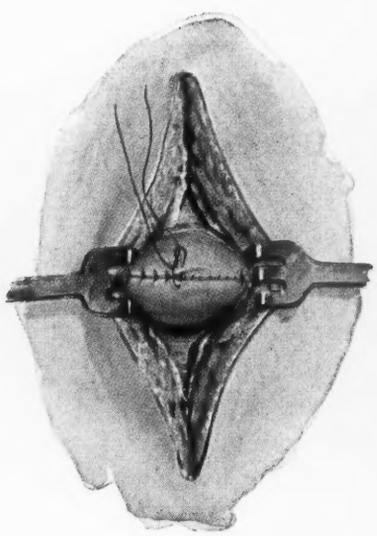
I: Sigmoid Colostomy – spur crushed previously.



IV: Colostomy closed transversely to avoid stenosis. First layer of inverting continuous suture being placed.

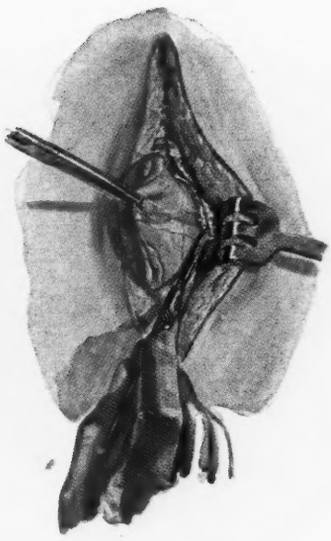


V: First suture layer completed.

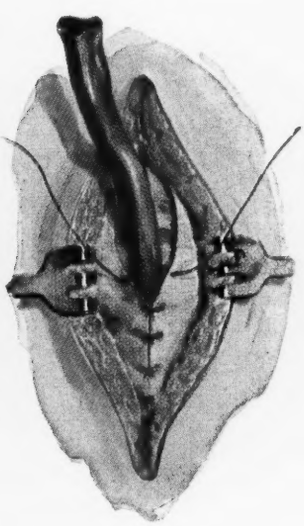


VI: Second layer of sutures (interrupted) are being placed.

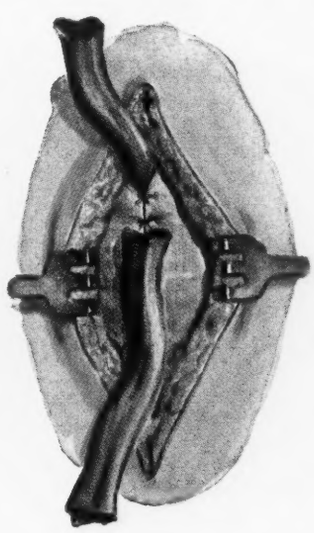
II: Scar excised and muco-cutaneous junction incised.



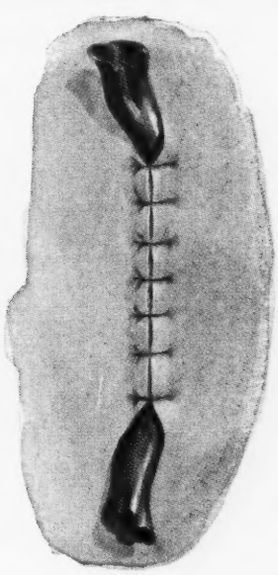
III: Aponeurosis incised above and below bowel and separated from it. Peritoneum left intact.



VII: Aponeurosis closure over bowel and over drain.

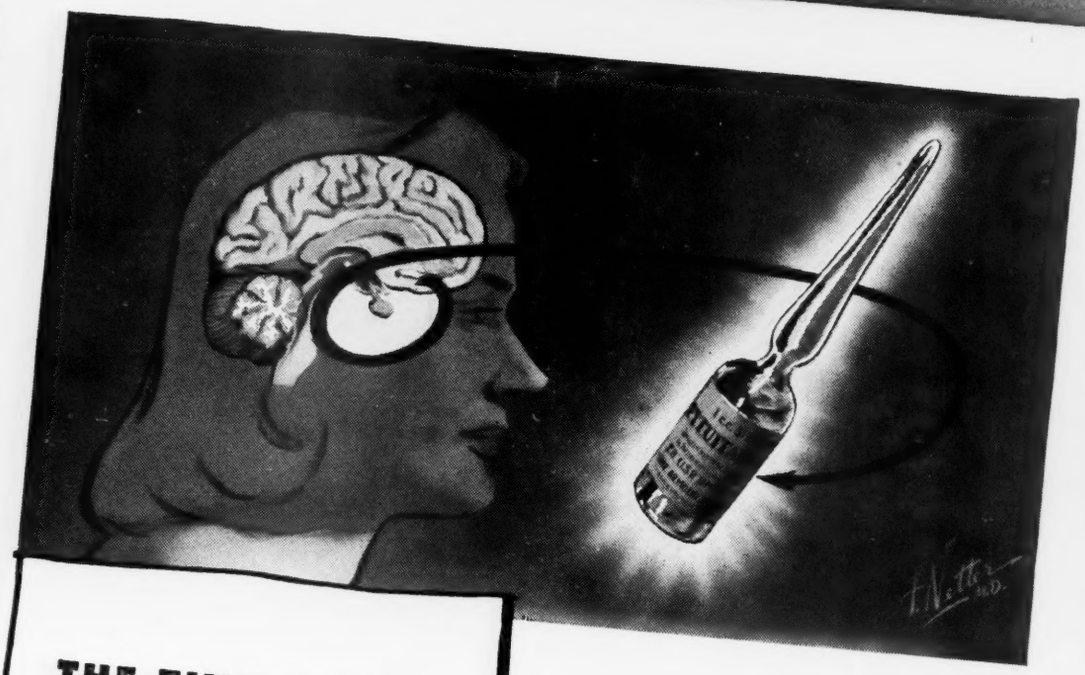


VIII: Subcutaneous drain emerges from the lower angle.



IX: Closure completed.

Armour Sutures and Ligatures



THE TINY GLAND *of* VITAL SECRETION

It is truly an amazing physiologic phenomenon that so small a structure as the posterior lobe of the pituitary gland secretes a solution with so powerful an effect throughout the body. Therapeutically this secretion has great value for its action on the uterus and on the smooth muscle of the intestinal tract. In obstetrics it is employed during the third stage of labor for hastening the expulsion of the placenta and controlling hemorrhage. In surgery and in medical practice it is used for relieving tympanites, abdominal distention and partial ileus. Sound judgment is important in the use of this potent physiologic agent. Equally important is the reliability of the product employed.

In the preparation of PITUITARY LIQUID *ARMOUR* (posterior lobe) no efforts are spared to insure purity and accurate standardization. The physiologic potency of every batch is "pre-measured" by determining kymographically its ability to contract strips of guinea pig uterus within carefully defined limits. In the ARMOUR LABORATORIES this test is carried out with the utmost of care, for *all* ARMOUR medicinals must live up to the high reputation they have earned.

Have confidence in the preparation you prescribe—specify ARMOUR

Rx Pituitary Liquid Armour

(A brand of Posterior Pituitary Injection, U. S. P. XII)

Available in ½ cc. and 1 cc. ampoules, providing 10 U. S. P. Units per cc. Accepted by the Council on Pharmacy and Chemistry of the American Medical Association.

The ARMOUR LABORATORIES • ***Chicago 9, Illinois***

HEADQUARTERS FOR MEDICINALS OF ANIMAL ORIGIN

Logically

. . . You'll want to eliminate outmoded technics and equipment with

POUR-O-VAC SEALS

the modern, reusable hermetic closure for sealing, storing, handling and conserving surgical fluids.

THESE FACTS ARE CONVINCING . . .

Pour-o-vac Seals eliminate the possibility of sterile water contamination caused by intake of bacteria-laden dust . . . avoids contamination by unfiltered air.

They serve a secondary function of providing a dustproof seal for remaining fluid when only the partial contents of a container are used. Of importance, they are interchangeable with all Fenwal 3000, 2000, 1000 and 500 ml. containers.

In permitting contents to be stored for long periods under vacuum . . . periodic testing for sterility without breaking the hermetic seal . . . pouring of contents from a non-drip sterile lip, Pour-o-vac seals eliminate the wasteful, time-consuming and questionably scientific method of sealing with gauze, cotton, paper, string and tape.

ALSO INVESTIGATE—Fenwal Automatic Washing Units, capable of accommodating and thoroughly cleansing 4 containers in 30 seconds.

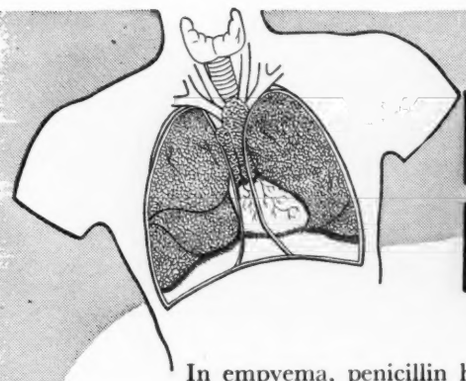
HEADQUARTERS FOR SCIENTIFIC GLASS BLOWING LABORATORY AND CLINICAL RESEARCH APPARATUS, REAGENT CHEMICALS

ORDER TODAY or write immediately for further information

Fenwal

MACALASTER BICKNELL COMPANY

243 Broadway **Cambridge, Massachusetts**



In Pulmonary Infections

In empyema, penicillin has proved of excellent value. Even in multiple loculi, aspiration followed by local instillation, with or without concurrent systemic administration of penicillin, has produced comparatively rapid sterilization of the cavity. Penicillin proves similarly effective when infection is super-imposed on bronchiectasis or upon pulmonary cysts. Though surgery may be indicated, penicillin appears as a valuable therapeutic adjuvant. In metastatic pulmonary infections due to penicillin-susceptible organisms, it may well prove lifesaving.

In 17 cases of empyema (10 streptococcal, 7 pneumococcal), repeated cavity aspiration was followed by injection of penicillin (1,000 units per cc.)—dosage adjusted to cavity size. Permanent sterilization of the cavity was attained with total dosages ranging from 40,000 to 200,000 units.

Butler, E. C. B.; Perry, K. M. A., and Valentine, F. C. O., Brit. M. J. 2:171 (Aug. 5) 1944.

●

Three cases of postlobectomy empyema showing mixed infection, with Cl. welchii in the drainage, responded favorably to penicillin and open drainage. Penicillin was given parenterally for 15 to 18 days, in total dosages up to 3,600,000 units.

Poppe, J. K., J. Thoracic Surg. 13:340 (Aug.) 1944.

●

Frequent aspiration of the cavity, and injection of 10,000 to 25,000 units of penicillin, resulted in sterilization of empyema cavities in 19 patients. In another study comprising 34 cases of pneumococcic empyema, aspiration of pus and daily injection of penicillin maintained a high penicillin concentration in the pleural cavity and obviated surgical drainage.

Lockwood, J. S.; White, W. L., and Murphy, F. D., Ann. Surg. 120:311 (Sept.) 1944.

●

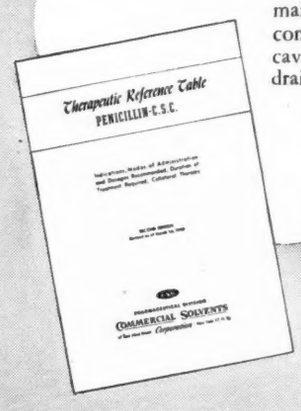
Eight children suffering from pulmonary suppurative disease received penicillin treatment—all recovered. 3 cases of staphylococcal empyema received 30,000 to 40,000 units systemically each day. In 2 of these, an additional 20,000 to 30,000 units was injected intrapleurally per day. Two patients with pulmonary abscesses received 40,000 units intramuscularly for 10 and 24 days, respectively. 3 patients undergoing lobectomy or pneumonectomy received 5,000 units intramuscularly every 3 hours for 10 to 14 days.

Herrell, W. E., and Kennedy, R. L. J., J. Pediat. 25:505 (Dec.) 1944.

●

Penicillin was administered systemically in 16 cases of pulmonary suppuration (all sulfonamide-resistant). Average daily dosage, 120,000 units. Included in the series was a case due to actinomyces which showed dramatic improvement. Intrapleural instillation of penicillin eradicated secondary infection from 7 cases of tuberculous pleural effusion with empyema.

Roberts, J. E. H.; Tubbs, O. S., and Bates, M., Lancet 1:39 (Jan. 13) 1945.



The Penicillin-C.S.C. Therapeutic Reference Table shows the dosages, modes of administration, and duration of therapy recommended in the conditions in which penicillin is the recognized treatment. A copy of the Second Edition, revised as of March 1st, 1945, has been mailed to every physician. If your copy has not been received, please notify us.

PENICILLIN-C.S.C.

In many of the country's renowned hospitals Penicillin-C.S.C. has become the preferred antibiotic of its kind—has gained the confidence and wholehearted acceptance of the medical and nursing staffs.

Reactions are encountered with extreme rarity, even when high dosages are required for prolonged periods. For Penicillin-C.S.C. is dependably pyrogen-free, non-toxic, and sterile. Its potency is always as stated.

Whenever penicillin is indicated, Penicillin-C.S.C., backed by rigid laboratory control in manufacture and painstaking biologic and bacteriologic assays, will fulfill the physician's every expectation.

PHARMACEUTICAL DIVISION

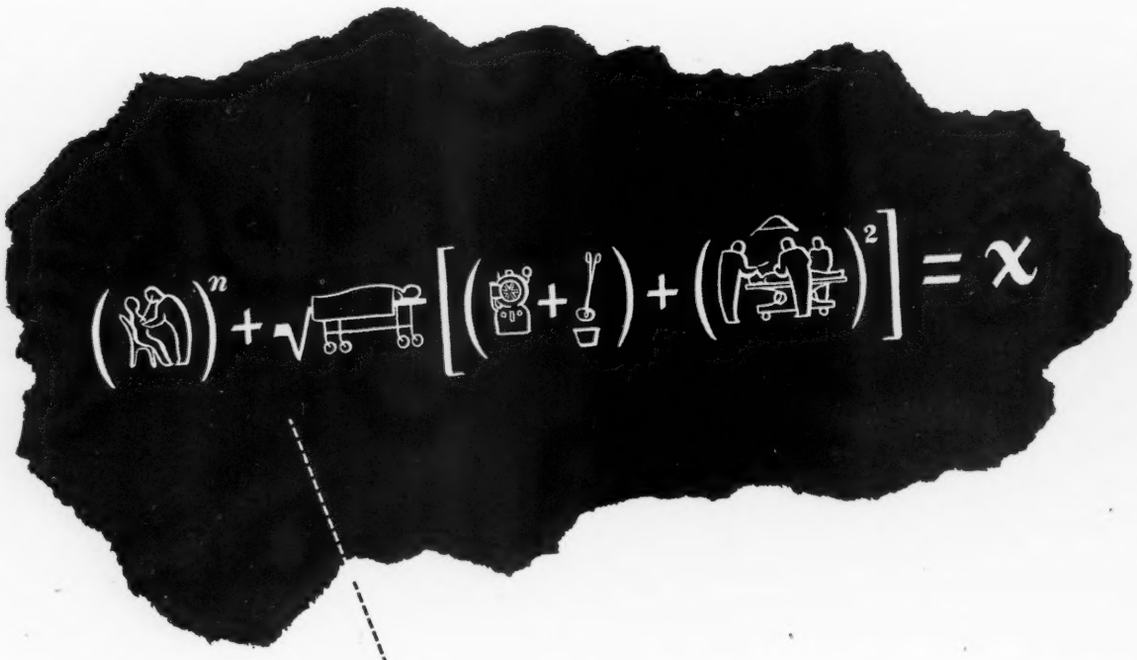
COMMERCIAL SOLVENTS
Corporation

17 East 42nd Street — New York 17, N. Y.

CSC

ACCEPTED AMERICAN MEDICAL ASSN.

Penicillin-C.S.C. is accepted by the Council on Pharmacy and Chemistry of the American Medical Association.



If Surgery could be reduced to a formula...

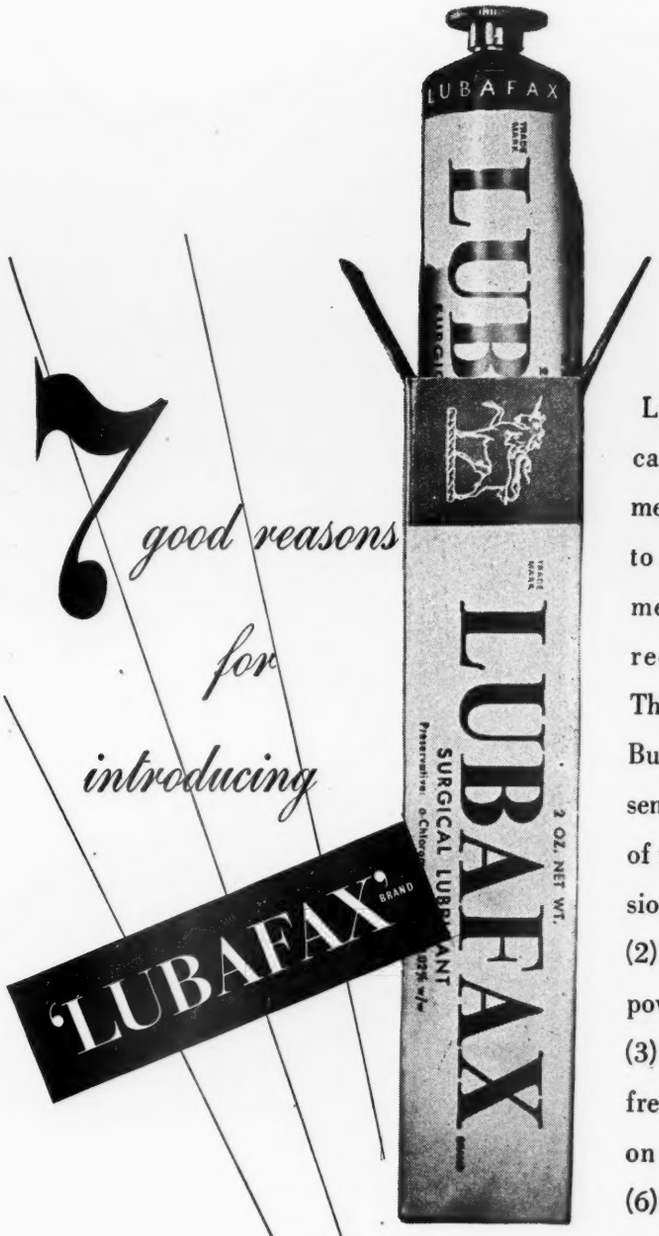
. . . two important factors in the equation would inevitably be rigorous aseptic and antiseptic measures. The values of such measures might be difficult to state with mathematical precision, but they are not unknowns. In the case of antiseptic agents, data on effectiveness, duration of action, and freedom from irritation are available *on a comparative basis.* Two independent investigators[1] have subjected fifteen antiseptics, including most of those in common use, to a series of carefully-controlled tests. As a result, they nominated Tincture Metaphen *the most effective agent tested.* On the oral mucosa, Tincture Metaphen was found to reduce bacterial count 95% to 100% within five minutes; to cause only slight irritation in a few cases, none in others, and to have, in substantial excess over other agents tested, a two-hour duration of action. Tincture Metaphen 1:200 is available through hospital and prescription pharmacies everywhere in 1-ounce, 4-ounce, 16-ounce, and 1-gallon bottles. ABBOTT LABORATORIES, North Chicago, Ill.

Tincture Metaphen

REG. U. S. PAT. OFF.

(4-nitro-anhydro-hydroxy-mercury-orthocresol, Abbott)

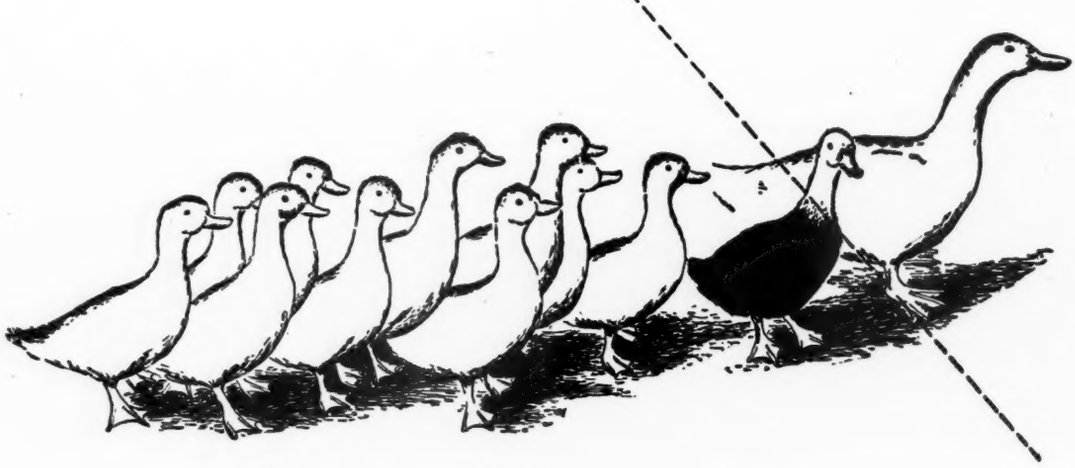
1. Meyer, E., and Arnold, L. (1938), Amer. J. Digest. Dis., 5:418.



Lubafax' brand Surgical Lubricant is the newest lubricating medium—and we believe the best, to facilitate manual and instrumental examination of vagina, rectum, urethra and bladder. There are seven good reasons why Burroughs Wellcome & Co. presents 'Lubafax' for the preference of the profession—(1) better adhesion to moist, warm instruments, (2) better retention of lubricating power and dependable uniformity, (3) greater transparency, (4) lower freezing point, (5) greater stability on prolonged exposure to heat, (6) greater bacteriostatic action, and (7) easier to wash off instruments and gloves with hot or cold water because of its complete solubility through a wide range of temperature. Available in tubes of 2 oz. and 5 oz.

BURROUGHS WELLCOME & CO. (U.S.A.) INC 9 & 11 EAST 41ST STREET, NEW YORK 17, N. Y.

for both **exception** *and the rule*



While functional constipation is usually founded on long-term neglect, exceptional circumstances often bring transient distress to otherwise careful individuals. Dietary indiscretion, a sudden change in environment, travel and other modifications in the daily routine are frequent precipitating factors.

Whether constipation be the exception or the rule, the return to normal bowel function is favored by the gentle moderating action of

'agarol'* *Emulsion*

*Trademark Reg. U. S. Pat. Off.

Replacing deficient bulk and lubricating factors while providing the minimal threshold stimulus for comfortable evacuation, 'AGAROL' Emulsion offers a simple, safe and reliable means of treatment. Supplied in bottles of 6, 10 and 16 fluidounces.

WILLIAM R. WARNER & CO., INC., 113 West 18th Street, New York 11, N. Y.

Announcing

the attainment of another objective
in the field of nutrition

The SQUIBB THERAPEUTIC FORMULA Vitamin Capsule is a *truly* therapeutic mixed vitamin preparation. It is founded on the concept that therapeutic requirements *cannot* be met by any simple multiple of present maintenance dosages.

Squibb Therapeutic Formula, based on practical clinical experience, provides the following dosages of therapeutic magnitude in a single capsule:

Vitamin A	25,000 units	Riboflavin	5 mg.
Vitamin D	1,000 units	Niacinamide	150 mg.
Thiamine HCl	5 mg.	Ascorbic Acid	150 mg.

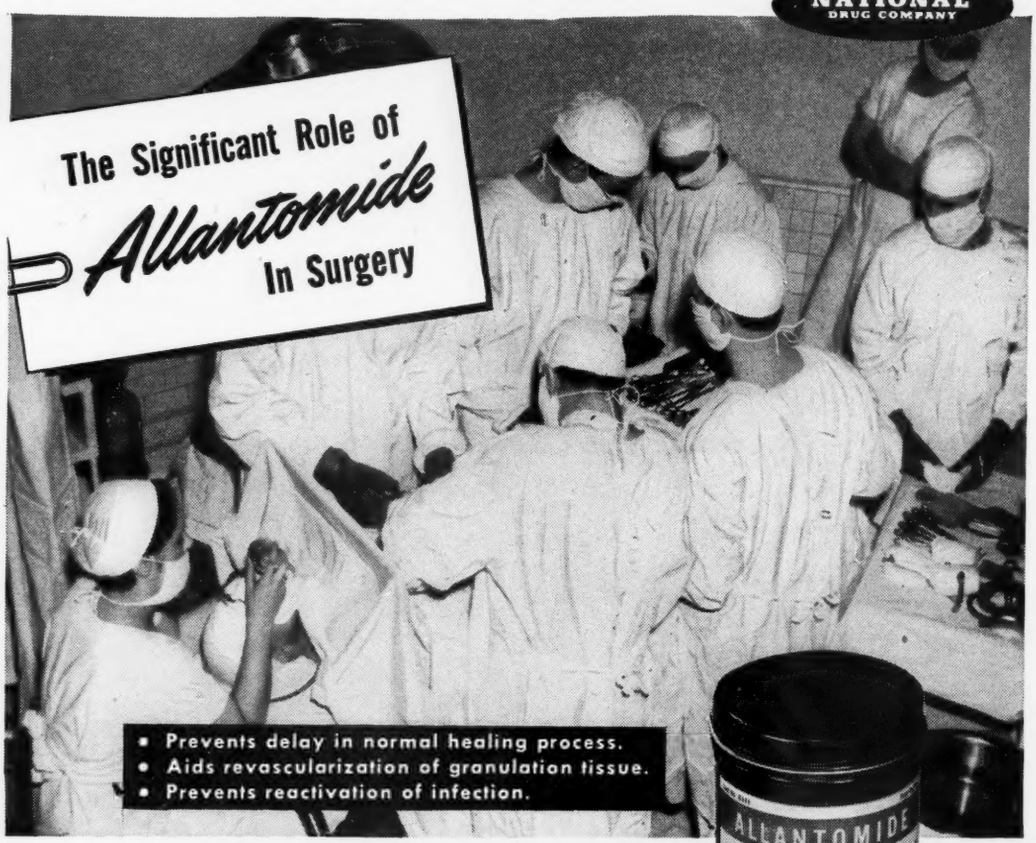
SQUIBB Therapeutic Formula

VITAMIN CAPSULES

MANUFACTURING CHEMISTS TO THE MEDICAL PROFESSION SINCE 1858

BIOLOGICALS, BIOCHEMICALS, PHARMACEUTICALS FOR THE MEDICAL PROFESSION

NATIONAL DRUG COMPANY


The Significant Role of
Allantomide
In Surgery
• Prevents delay in normal healing process.
• Aids revascularization of granulation tissue.
• Prevents reactivation of infection.

IN AN extensive series of surgical studies, Veal, Klepser and associates stress the value of Allantomide in overcoming certain difficulties often encountered with ordinary local sulfonamide preparations. They state:

"... allows a prompt resumption of the normal healing process and at the same time maintains a clean wound."[1]

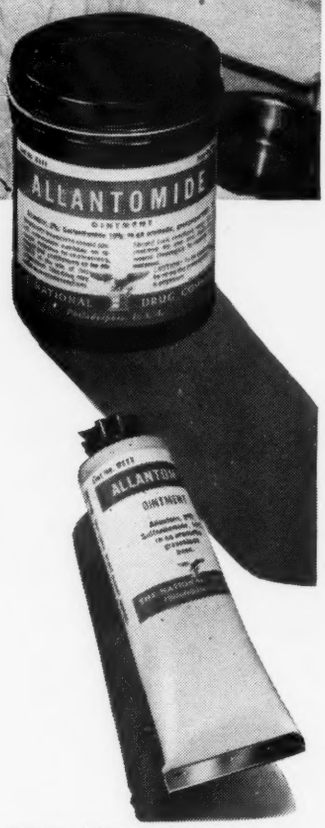
"The excellent results obtained by preparing some forty superficial wounds for skin grafting by the local use of sulfanilamide and sulfanilamide-allantoin ointment (Allantomide) have been most encouraging."[2]

"... in our series of over 2,000 cases of infected wounds, we have found 10 per cent sulfanilamide and 2 per cent allantoin in a greaseless base (Allantomide) to have many advantages."[3]

1. Veal, J. R., and Klepser, R. G., Surgery, 10:947-956, Dec. 1941.
2. Veal, J. R., Klepser, R. G., and Devito, M. P., Am. J. Surg., 54: 716-720, Dec. 1941.
3. Veal, J. R., and Klepser, R.G., South. Med. J., 36:292-295, April 1943.

We shall be glad to supply further information on Allantomide upon request.

Allantomide



Allantomide is available in one-ounce tubes, and in four-ounce, one-pound and five-pound jars.

THE NATIONAL DRUG COMPANY, PHILADELPHIA, PA.

Sharply outlined

with safety

The urinary tract is sharply outlined with the use of NEO-IOPAX for intravenous urography. Calices, pelvis and ureter are clearly visualized within 5 to 10 minutes.

Neo-Iopax urography

assures adequate contrast in the diagnosis of congenital anomalies, hydronephrosis, pyelonephrosis, tumors, renal calculi and ureteral strictures.

NEO-IOPAX, a stable solution of pure disodium N-methyl-3,5-diiodo-chelidamate, in ampules of 50% or 75% solution for intravenous use. It may be diluted to 20% solution for *retrograde pyelography*.

TRADE-MARK NEO-IOPAX
—REG. U. S. PAT. OFF

SCHERING

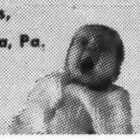
Schering CORPORATION • BLOOMFIELD, N. J.

to alleviate prolonged postpartum depression

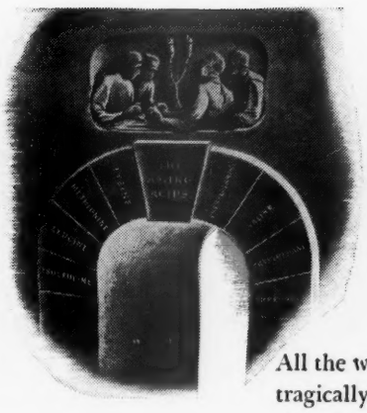
A dreary sense of futility, emptiness and pessimism sometimes afflicts the postpartum patient and may prolong the period of recovery. When the characteristic syndrome of true depression follows childbirth, the administration of Benzedrine Sulfate is often of dramatic value. Obviously, it should not be used for the casual case of low spirits or normal physiological depression as distinguished from a true and prolonged mental depression.

benzedrine sulfate
(racemic amphetamine sulfate, S. K. F.)
tablets and elixir

Smith, Kline & French Laboratories, Philadelphia, Pa.



Paul Rand



Vital Support in Modern Surgery

All the wealth of modern surgical skill and knowledge may be tragically unavailing if the patient is physically unfit for operation. In poorly nourished patients, preoperative correction of hypoproteinemia lessens surgical risk . . . hastens healing. Parenamine—clinically proved parenteral substitute for dietary protein—restores and maintains positive nitrogen balance . . . corrects hypoproteinemia . . . stimulates regeneration of tissue and serum proteins.

Parenamine

AMINO ACIDS STEARNS PARENTERAL

For protein deficiency

PARENAMINE is a sterile 15 per cent solution of all the amino acids known to be essential for humans, derived by acid hydrolysis from casein and fortified with pure *dl*-tryptophane. Sterility, freedom from pyrogens, and standardization of each batch are meticulously checked by laboratory procedures, animal testing, and injection of full therapeutic doses clinically.

INDICATED in protein deficiencies and conditions of restricted intake, faulty absorption, increased need, or excessive loss of proteins. Particularly useful in preoperative and postoperative management, nephrotic toxemia of pregnancy, extensive burns, delayed healing, gastrointestinal disorders, cirrhosis, nephrosis, fevers, and other hypermetabolic states.

ADMINISTRATION may be intravenous, intrasternal or subcutaneous. Dosage may be estimated at 1 Gm. amino acids per kilogram of body weight per day, plus sufficient excess to correct the existing deficiency.

SUPPLIED as 15 per cent sterile solution in 100 cc. rubber-capped bottles.

Complete clinical information will be gladly sent on request.

Frederick Stearns & Company

Division

DETROIT 31, MICHIGAN

NEW YORK KANSAS CITY SAN FRANCISCO WINDSOR, ONTARIO SYDNEY, AUSTRALIA AUCKLAND, NEW ZEALAND

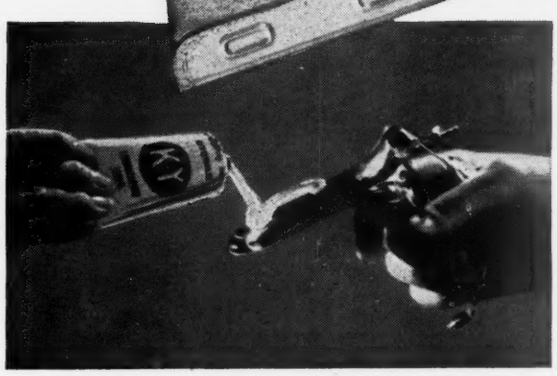
Trade-Mark Parenamine Reg. U. S. Pat. Off.

slickest thing for gloves and instruments

• This bland, greaseless jelly spreads readily over rubber, metal, or synthetic surfaces. It forms a lubricating film that adheres well, but may be washed away easily. Its exceptional lubricating quality facilitates procedure and minimizes discomfort to the patient.

K-Y* Lubricating Jelly is sterile, water-miscible, transparent—harmless to gloves, instruments and human tissue.

ORDER FROM YOUR DEALER



SPREADS READILY—ADHERES

Active ingredients: chondrus, tragacanth, glycerine, water, boric acid.

K-Y LUBRICATING JELLY

Johnson & Johnson

NEW BRUNSWICK, N. J. CHICAGO, ILL.

*Trade-mark of product made exclusively by Johnson & Johnson

The American Journal of Surgery

Copyright, 1945 by The Yorke Publishing Co., Inc.

A PRACTICAL JOURNAL BUILT ON MERIT

Fifty-fourth Year of Continuous Publication

NEW SERIES VOL. LXX DECEMBER, 1945 NUMBER THREE

Editorial

CONDITIONED TO THE DISC

FORTY years ago the most fashionable designation for a pain in the belly was appendicitis. Today the most fashionable designation for a pain in the back with radiation into a lower extremity is a "disc lesion."

There is a great similarity in the reaction of the medical profession and the lay public to both of these manifestations of a pathological condition. There is, however, a profound difference. The inflamed appendix threatened death; its removal under proper circumstances removed both the threat of death and the painful manifestations. The therapeutics of the newly discovered disc never involves the threat of death, but only the relief, in general, of a more or less transient pain or disability.

That to the degenerative lesions of the lower lumbar intervertebral discs are to be ascribed an important rôle in the clinical manifestations of "low back" disability can not be denied. Indeed it is remarkable that the first student of the pathology of the intervertebral disc, Schmorl of Dresden (1925), recognized "nuclear protrusions" only in the sense of "nodes" protruding into the centrum of the vertebral body. Furthermore, Danforth and Wilson (1925) despite their acute observation that the lower lumbar intervertebral foramina decrease in size from above downward, found no disc "herniations." Mixter and Barr (1934) forcibly pointed out the rôle of "herniations of the nucleus pulposus."

The adult human lumbosacral region is no doubt a weak area from the biological standpoint. It shows the evidences of wear and tear, as do human feet, by virtue of late adaptation to the upright posture. In the main the race accepts these as temporary, intermittent, and sometimes chronic handicaps, and has found minor means to circumvent them, either by the employment of rest, heat, exercises, manipulation, or artificial support, and in view of the usually temporary nature of the symptomatic manifestations, it is not surprising that any one or a combination of such means is apt to be credited with the "cure."

There are however, at least three causes of low back pains and "sciatica" which cannot be dismissed so easily: (1) Intrinsic lesions of the vertebral column, and spinal cord, such as primary or secondary new growth; fractures and dislocations; inflammatory processes, such as osteomyelitis, Pott's disease, and Marie-Strumpell's arthritis. (2) Gross developmental abnormalities such as spondylolisthesis. (3) Neurotics and litigants. It is easy to assume that this or that person with a backache is a neurotic or that this or that

person, having suffered a low back "sprain" is actuated consciously or unconsciously by a desire for gain or to seek consciously or unconsciously, surcease from an uncomfortable set of environmental circumstances but such an assumption should not be made without a thorough investigation of the patient. In the early days of the appendicitis era, the neurotic patient, usually a female, was exposed to successive laparotomies, and indeed, invited them, and came to be known among surgeons as "surgical junk." The neurotic and the "low back" litigant of our day is in a fair way to be thrown upon a similar junk heap by the employment of injudicious operations.

There exists, however, a distinct field for surgical operations on the low back. A patient, comparatively free of neurotic or litigant factors, who is a subject of chronic invalidity or of recurrent acute episodes of acute and painful disability with its resultant physical incapacity, is a fit subject for surgical intervention. Occasionally a neurotic or a litigant may derive proper benefit from such intervention if the circumstances are favorable or if there is a gross structural defect.

As to the form of surgical intervention in recalcitrant cases, this much may be said. There is occasionally a case in which the "sciatic" symptoms are so severe, with muscular atrophy of pronounced degree, and with reflex and sensory changes, as to warrant intraspinal exploration for an assumed nuclear protrusion. Should such gross protrusion be found (which is by no means the rule), the patient will get relief of the radiation symptoms, but will be left with a structurally weak back by virtue of the collapse of the disc.

The primary function of surgical operation for the "low back" of the recalcitrant type is stabilization of this structure. Stabilization will alleviate not only the symptoms of radiating pain which are produced by motion and strain, but may be expected to, in definitive fashion, correct the underlying weakness of structure. Hibbs found it out more than forty years ago, and his observation holds good today.

Arthur Krida, M.D.

Original Articles

HEMORRHAGE AS THE MOST FREQUENT CAUSE OF MATERNAL DEATH*

AN ANALYSIS OF THE PUERPERAL DEATHS IN BROOKLYN, 1944

CHARLES A. GORDON, M.D.
BROOKLYN, NEW YORK

EACH year since 1935 the Brooklyn Gynecological Society has devoted the May meeting to a discussion of maternal mortality. And since 1938, with the cooperation of the Commissioner of Health of the City of New York and Mr. Thomas S. Duffield, Director of the Bureau of Records and Statistics of the Department of Health, as well as the Visiting Nurse Association of Brooklyn and every hospital, the Brooklyn Committee on Maternal Welfare has been able to present to the medical profession a detailed analysis of the maternal deaths which have occurred during the preceding year.

In the City of New York there were 132,735 births in 1944. The largest number of births occurred in the Borough of Brooklyn, 51,082; of these, 3,502 were non-white. The puerperal mortality rate per 10,000 reported terminated pregnancies, standardized for color, declined to a new low level in the entire city to 16.6. Calculated in the same way, the official puerperal mortality rate for Brooklyn is 12.4, the lowest of the five boroughs, and the lowest rate, I believe, yet recorded for any borough of the City of New York.

In the entire city of New York there were 222 puerperal deaths and an additional twenty-six deaths associated with pregnancy and childbirth, but not assigned to puerperal causes. In Brooklyn there were sixty-two puerperal deaths, and eight others officially assigned to non-puerperal causes.

In the following tabulation of the Bureau of Records and Statistics the puerperal causes of death are separated for statistical study. The year 1943 is added for comparison. (Table 1).

TABLE 1
PUERPERAL DEATHS—BROOKLYN 1944

		1944	1943
140–141	Abortion	10	19
142	Ectopic	3	9
143–146	Hemorrhage	8	20
144–148	Toxemia	11	19
147	Infection	20	20
145–149	Other diseases and accidents	8	16
150	All other	2	9
	Total	62	112
	Reported terminated pregnancies	51,082	55,660
	Rate	12.4	20.5

We have learned that no complete analysis of maternal mortality may be made without giving due weight to the deaths assigned to puerperal causes secondarily. Yet we know that even those secondary causes which appear in the puerperal death column itself do not figure in computations from which important deductions are made. It is certain that observation of any maternal death problem must be critical to be valuable. And conclusions should be drawn, not from study of official figures alone, but after review of the case records which illuminate

* Read at a meeting of the Brooklyn Gynecological Society, May 4, 1945.

the statistics. But for the rules which govern the statistician, three more cases may have been added to the total of puerperal deaths. The essential data of these three cases follow:

Case I. *Assigned to cardiac disease:* A young primigravida undelivered, who had excellent prenatal care, died of heart failure after fifty-six hours of labor.

Case II. *Assigned to chronic nephritis:* A primipara, aged thirty-eight years, with chronic nephritis, died of shock shortly after cesarean section.

Case III. *Assigned to chronic nephritis:* A multipara in the sixth month of pregnancy with severe hypertension, partial separation of the placenta and fetal death was treated by Voorhees bags, followed by version, craniotomy, decapitation and manual removal of the placenta under general anesthesia; laceration of the cervix was repaired, and the vagina was packed to control bleeding. Death was directly due to uremia sometime later.

DEATHS EARLY IN PREGNANCY

There were thirteen deaths early in pregnancy, ten due to abortion and three to ectopic pregnancy. Hemorrhage was the actual cause of death in no less than seven cases of abortion. In one case death followed sudden profuse hemorrhage at home two days after spontaneous abortion. In two cases hemorrhage was so severe during removal of retained tissue, that operation was stopped and the uterus packed; and in another case profuse and repeated hemorrhage caused death after vaginal hysterotomy for missed abortion.

In all three cases of ectopic pregnancy intraperitoneal hemorrhage was great. In one case death was directly due to wound rupture and intestinal obstruction. The cause of death in the other two cases was discovered at autopsy. In one case death occurred one hour after admission to the hospital; and in the other the diagnosis was repeatedly missed, death in shock occurring three hours after re-admission to the hospital.

TOXEMIA OF PREGNANCY

In this group of eleven cases, six women died before delivery. In one of these cases death was directly due to anesthesia, and the case report does not mention toxemia. A multipara, with three normal deliveries previously was taken to the delivery room after long but poor labor. Forceps delivery was attempted under open drop ether anesthesia. Death from aspiration of vomitus occurred before delivery.

In the delivered group of five cases, prenatal care was good in but two cases. In the two cases in which cesarean section was performed, death was due to nephritis in one case and to peritonitis in the other. In two cases hemorrhage was an important factor in death:

Case IV. Eight days after spontaneous delivery, a primipara with severe pre-eclampsia bled profusely from the vagina for several hours before placental tissue was removed from the uterus. On the following day the patient left the hospital against advice. After further bleeding at home for a week, she was admitted to another hospital where, a few days later, she died of severe secondary anemia and vascular disease.

Case V. A primipara after low forceps delivery under open drop ether anesthesia suffered a profuse postpartum hemorrhage. During the next three hours she was given ergotrate, morphine, adrenalin, oxygen, intravenous glucose and 250 cc. of plasma.

INFECTION

Infection is the largest group statistically. In only six cases was another puerperal cause coded secondarily, as follows: hemorrhage (1), toxemia (3) and cesarean section (2). A primipara, aged nineteen years, discharged from the hospital on the fifth day after normal delivery, died of diffuse peritonitis at home one week later. And a multipara died of massive pulmonary embolism in the hospital on the sixth day after home delivery.

The trauma and shock of operative pelvic delivery were important factors in two

cases in which hemorrhage apparently was not significant.

Case VI. After fifty-three hours of labor a primipara was delivered of a large stillborn fetus under deep anesthesia by difficult high forceps, after incision of the cervix. Though blood loss was not more than 400 cc., profound shock followed immediately. Death which occurred before transfusion could be completed was attributed to pulmonary embolism.

Severe hemorrhage occurred in seven patients in this infection group, one of them associated with rupture of the uterus. The essential facts of three interesting cases will illustrate:

Case VII. After forceps delivery of a multipara, the placenta was retained. Manual removal and packing of the uterus followed, though bleeding was said to be moderate. Uterine contraction could not be maintained. Death in shock occurred after administration of plasma and oxygen.

Case VIII. Severe postpartum hemorrhage occurred three hours after midforceps delivery of a stillborn infant. Treatment consisted of vaginal pack, sandbag over the uterus and plasma. Death one hour later was attributed to pulmonary embolism.

Case IX. A young woman, gravida ii was admitted to the hospital in shock after a blood loss of 2,000 cc. at home. No fetal heart could be heard. Her condition improved after transfusion of 500 cc. of blood and 500 cc. of plasma. A few hours later a diagnosis of central placenta previa was established by vaginal examination, and a Voorhees bag was inserted in the cervix after gentle manual dilation. Shock recurred. Another 500 cc. of blood and two units of plasma were then administered simultaneously. The bag was removed, the cervix manually dilated and version and extraction performed. The placenta was removed manually. Death on the ninth day postpartum was due to pulmonary embolism, proved by autopsy.

Actually there was but one case of toxemia in the infection group, and, in this case death was ascribed to pulmonary embolism, though it occurred during a severe convulsion. Every year in the study of a large infection group it has been our experience that it contains a very considerable number of cases difficult of exact assignment to any one particular cause of death.

CESAREAN SECTION

Cesarean section contributed to death in eight cases. In five cases in which the classical operation had been performed, death was due to infection; and in three of these cases sulfanilamide had been left in the abdomen. In one case of placenta previa associated with profuse antepartum hemorrhage, death, weeks later, was directly due to infection; 250 cc. of blood were administered nearly three weeks after operation. In two other cases death within one hour after operation was attributed to shock; plasma was administered, but blood was not available for either of these women.

RUPTURE OF THE UTERUS

We are aware that, since 1937, approximately 6 per cent of our maternal deaths, exclusive of ectopic pregnancy and abortion have been due to rupture of the uterus.[4] Generally thought to occur infrequently, its importance as a considerable increment of maternal mortality rates is not generally appreciated. In 1944, six women died of this cause.

In four cases diagnosis was not made until after death, and in one of these cases the uterus had been explored, after version and manual removal of the placenta. In three cases rupture was spontaneous, one of them due to previous cesarean section. Version was the cause of rupture in two cases, and rupture was due to manual rotation and forceps delivery of a hydrocephalic fetus in another.

Blood replacement was inadequate. In only one case did the patient receive blood, and in two cases plasma was administered. Only one operation was performed in this group. In this case rupture occurred in the hospital after twelve hours of labor. Death occurred four hours after hysterectomy. Plasma was administered, but not blood.

HEMORRHAGE

Statistically only eight cases were assigned to this cause as the principal cause of death, and in three more cases hemorrhage was coded as a secondary cause. In the total number of thirty-five cases which I have assigned to hemorrhage, I do not contend that death was due to blood loss alone, for in some of these cases death was finally due to embolism or peritonitis or some other form of puerperal infection. Only those cases are included in which hemorrhage was said to be profuse or severe, or when the uterus was packed or ruptured. Cases of shock or sudden death are not included if the case record stated that blood loss was moderate or not excessive. The following case, for instance, is not included:

Case x. An obese primigravida, age thirty years, after eighty-nine hours of poor labor was taken to the delivery room when she became exhausted and irrational. Her temperature had risen to 101°F. and the pulse rate was 140. Since the fetus was dead, its head was perforated. The patient died undelivered shortly afterward.

Time will not permit of a detailed account of all the cases in which hemorrhage was a prominent cause of death. Some of them have been related elsewhere in this report. Brief descriptions of cases which illustrate different situations follow:

Case xi. A primipara who had previously been admitted to the hospital for bleeding in the eighth month was readmitted, bleeding actively, after twenty hours of labor. Two hours later, unattended delivery in bed was followed by profuse hemorrhage and shock. The uterus was packed and plasma and 750 cc. of blood were administered before death.

Case xii. A primipara bled repeatedly from placenta previa before entering the hospital when bleeding became profuse. A Voorhees bag, which had been introduced with weight attached, was expelled one hour later. Version and extraction, difficult because of a nine pound fetus, followed. The uterus and vagina were packed without controlling hemorrhage. Oxytocics, oxygen and 1,000 cc. of plasma were administered.

Case xiii. A primipara early in labor bled vaginally so the membranes were ruptured artificially. Two hours later spontaneous delivery of a dead fetus was followed by profuse hemorrhage and expulsion of the placenta. Hemorrhage was repeated at intervals for three hours when death occurred in shock. Coramine, caffeine, morphine, adrenal cortex and 1,000 cc. of plasma were administered, and the uterus massaged. Upon examination of the placenta, two cotyledons were found to be missing.

Case xiv. A primipara admitted to the hospital with vaginal bleeding received 500 cc. of blood and 500 cc. of plasma. Delivery was effected by low forceps four hours later. Spontaneous expulsion of a separated placenta was followed by 2,000 cc. of old blood. The uterus was packed, and coramine, caffeine and an additional 500 cc. of plasma were administered. Blood was available, but it was not compatible.

Case xv. A primipara with severe preeclampsia in the eighth month of pregnancy was admitted to the hospital bleeding profusely from the vagina. Hypertonic glucose and 1,000 cc. of saline were administered. When fully dilated seven hours later, version was performed. Shock and death followed.

Case xvi. In her second pregnancy a primipara who had been previously delivered spontaneously of a small baby, and who was subjected to a sequence of long labor, failed high forceps, failed version, craniotomy, another trial of version, amputation of the fetal arm and failure of decapitation, died of hemorrhage and shock. The uterus was not ruptured.

Case xvii. A primipara with rheumatic heart and hypertension was admitted to the hospital for rest in the thirty-third week of pregnancy. The membranes were ruptured artificially about ten days later, and when fully dilated, delivery was effected under ether-oxygen anesthesia by mid-forceps and episiotomy. The next day a large hematoma of the perineum and buttock was opened under ether anesthesia, and 400. cc. of clots evacuated. Shock followed. She later bled through the pack and was repacked twice later; 500 cc. of blood were administered. Death forty-eight hours after delivery was due to hemorrhage.

Hemorrhage was so commonly encountered in our case reports that we again find

it necessary to revise official figures in order to learn its true importance. The information on our certificates of death is for the most part reliable, yet we cannot expect them to show all the circumstances which surround maternal death. Nor can the Bureau of Records and Statistics do any more for us than tabulate the causes which appear on them.

Hemorrhage was a critical factor in thirty-five of the sixty-two cases assigned to puerperal causes of death, or 56 per cent of the total. This is greater than in 1943. Two cases of death from hemorrhage assigned statistically to the non-puerperal group are not included. The following table will show the importance of hemorrhage as a critical factor in the principal causes of death. (Table II.)

TABLE II
PUERPERAL DEATHS—BROOKLYN 1944, HEMORRHAGE AS A CONTROLLABLE FACTOR*

	Causes	No. as of Statistics	No. with Critical Hemorrhage Factor
140–141	Abortion	10	7
142	Ectopic	3	3
143–146	Hemorrhage	8	8
144–148	Toxemia	11	2
147	Infection	20	7
145–149	Accidents	8	6
150	Other	2	2
	Total	62	35

* Two non-puerperal deaths from hemorrhage are not included.

COMMENT

We have made good progress this past year. If the puerperal mortality rate for 1944 had been the same as in 1943, 105 women would have died, instead of sixty-two, an actual saving of forty-three mothers' lives. Yet even a superficial glance at our experience will show that there is much more to be done. Many controllable factors have been indicated. This is not the place for discussion of the importance of good judgment, or the fundamentals of diagnosis or the well accepted tenets of good obstetric practice. One penetrating generalization is worth more than all that.

The melancholy record of deaths from hemorrhage is proof that our securities against death from this cause are inadequate. The red torrent still inundates our statistics. Year after year it has been no different as the following table will show. (Table III.)

TABLE III
MAJOR CAUSES OF MATERNAL DEATH, BROOKLYN 1937 TO 1944

Year	Infection	Toxemia	Hemorrhage
1937	27	26	29
1938	27	18	27
1939	30	12	14
1940	18	10	28
1941	10	8	20
1942	25	22	30
1943	13	14	60
1944	16	9	35
Total	166	119	243

In May, 1938, I reported: "We have been made acutely aware of the importance of quick transfusion. Indications for transfusion are clear. No one can take exception to them. The hospital has a very definite obligation in this matter. Responsibility for the patient's welfare does not rest entirely with the doctor. Not only do women have a right to expect the hospital to be safe, but the best interests of patient, physician and hospital are served in no other way. This responsibility cannot be shirked."

For treatment of serious obstetrical hemorrhage, blood plasma is not sufficient. The importance of blood transfusion cannot be over evaluated. Large amounts are often necessary, and the sooner blood is given, the better; and speed during its actual administration is often vital. In the emergency when veins fail, or cut-down proves time consuming or unsuccessful, sternal transfusion is safe and effective.

We should know whether the Rh factor is present in our patients or not. It is clear that hemolysis caused by the Rh factor can be prevented if every Rh negative woman receives Rh negative blood of the same type as hers. Yet these donors may not be available, and proper anti-Rh serum is difficult to obtain and the test itself, though simple, is delicate and requires expert technical interpretation. Errors are not uncommon, and it is fortunate that many Rh negative women are not easily sensitized.

However, situations will arise when the need for blood replacement is acute, and trustworthy facilities for determination of the Rh factor are not at hand. In that emergency, Wiener's[5] biological test for sensitivity should be performed. If the test is negative, as it is likely to be, any quantity of the same blood may be administered with safety. Group O blood will not cause reactions if given to A, B and AB recipients unless its titer of anti-A and anti-B agglutinins is high. High titer O blood should be so labeled.

Brooklyn is a large urban center in which maternal mortality rates have differed but little from national statistical trends. In Brooklyn, hemorrhage is the most frequent and the most important cause of maternal death. The exact relation which our experience bears to the national scene is difficult to establish, yet there is good reason to believe that the situations are parallel.

REFERENCES

1. Gordon, C. A. *Am. J. Obst. & Gynec.*, 41: 535, 1941.
2. Gordon, C. A. *Am. J. Obst. & Gynec.*, 46; 884, 1943.
3. Gordon, C. A. *Am. J. Obst. & Gynec.*, 46: 366, 1943.
4. Gordon, C. A. and Rosenthal, A. H. *Surg., Gynec. & Obst.*, 77: 26, 1943.
5. Wiener, A. S. Blood Groups and Transfusion. 3rd ed. Springfield, Ill., 1943. Charles C. Thomas.

INTRAVENOUS OBSTETRICAL ANESTHESIA*

PRELIMINARY REPORT

FREDERICK M. ALLEN, M.D.
NEW YORK, NEW YORK

THE small literature on the intravenous use of drugs of the procaine class will be referred to in later more complete papers. As mentioned elsewhere,[1] experiments on shock impressed me with the selective permeability of capillaries in injured or inflamed areas, and led to speculation whether this change might be utilized for the introduction of beneficial substances into such areas. The experience of Lundy[2] in relieving pruritus in several jaundice cases suggested this introduction of local anesthetics. The oligarchic suppression of the entire shock research included prevention of the desired animal experiments along this line. Progress thus became transferred to Canada, where Gordon[3] and McLachlin[4] adopted the Lundy method, respectively for painless dressings of burns and for relieving pain after surgical operations.

It therefore appeared unavoidable to venture upon clinical trials without the anticipated experimental preparation. The Lundy technic was extensively modified[1] as follows: (1) The quantity of procaine and strength of solution were greatly increased; (2) the time of infusion was greatly lengthened; (3) saline was replaced by glucose solution in conditions in which edema might be harmful; (4) the range of application was extended to the widest variety of painful conditions. In fact, we are still searching for any kind of severe pain which cannot be relieved by procaine intravenously. The theory still appears valid that procaine circulating in a low symptomless concentration in the blood does not produce local anesthesia in normal tissues; but in regions of injury, pain, inflammation or edema the increased capillary permeability allows the procaine to diffuse into the tissues and anesthetize the nerve endings there. Any cases of pain not associated with this special vascular permeability will theoretically not be relieved.

Apprehension is natural at first concerning the safety of the method. If an infusion is begun very slowly, it presumably is safer than the usual local infiltration, because with this usual method the surgeon injects practically the entire quantity at once and is unable to stop the absorption as an intravenous drip can be stopped. We make routine tests for sensitiveness, however, in every preliminary preparation by injecting a drop of 1 per cent procaine solution intradermally. If there is any doubt, after fifteen minutes a drop can also be instilled into an eye, because the conjunctival reaction can scarcely be serious if the skin test is at all questionable after this interval. Few instances of hypersensitiveness have been encountered thus far. The doses infused by vein, though unprecedentedly large, have never occasioned anything more than dizziness or other harmless subjective symptoms, often with moderate tachycardia but never with alarming changes in circulation, respiration or other functions. The dosage is judged empirically by continuous observation in each case. There is complete absence of unpleasant accompaniments or after-effects. If untoward symptoms should ever develop, antidotes are available in the form of epinephrine subcutaneously for respiratory distress or a soluble barbiturate intravenously for muscular spasms. All experience to date, however, seems to indicate that

* From the City Hospital, Welfare Island, New York. This work was financially supported by Mr. Albert A. Volk of New York City.

danger is non-existent as long as the dosage is kept within the limits set by subjective symptoms such as giddiness, mental confusion or thick speech. The rapid destruction of procaine in the liver or elsewhere results in almost immediate clearing of symptoms when the infusion is stopped.

The obstetrical use of this method was suggested theoretically by the following considerations: (1) Caudal anesthesia with procaine is efficient in labor but requires environment and skill which are available to only a few fortunate women. (2) Labor pains originate from tissues which are edematous or congested so as probably to present the requisite increase of capillary permeability. (3) Procaine affects sensory nerves more quickly and strongly than motor nerves, therefore, it may be feasible to find a dosage which will at least reduce painful sensations while not diminishing uterine contractions.

The primary fact established by clinical experience is that labor pains can actually be alleviated in this way. The sensations are not entirely abolished within the limits of dosage mentioned, but they are reduced to a degree which makes them more easily endurable and which is very gratifying to the patient. The entire technic is still in process of development, and one of the first questions must be when to begin the treatment. Our provisional impression is that the infusion should usually not be begun in the earliest stage, especially in primiparas or any patients with mild pains, feeble uterine contractions and the prospect of long labor. The impression is that the relief of such pains may be attended by reduction of uterine contractions or even a temporary arrest of labor, so as to suggest the possibility that such infusions may be serviceable for checking threatened abortion. But in the second stage, when contractions are stronger and the suffering greater, the analgesic effect is most welcome; and here instead of delaying the birth process it seems rather to hasten it, because with the diminished suffering the voluntary muscles are used more effectively. In the third stage and also during perineal repair the sensations are also evidently diminished but not with the same effectiveness. Suffering and outcries are not prevented. These results are in accord with the theoretical postulate of selective local analgesia, and they are sufficiently marked to be practically useful. The giving of a simple intravenous infusion, without danger of unpleasant accompaniments, appears to have definite value for relief of pain during a certain part of labor.

It was natural to try for more complete effects by increasing the quantities of procaine. Progress was thus made into a field which is clinically new, namely, central anesthesia with procaine. For this purpose a strong infusion is given rapidly. Dizziness and other subjective symptoms are either ignored or prevented. The typical result is that the patient passes quickly into a state in which she feels far away, is aware of events and afterward remembers most of them, can understand questions and often can answer by nodding her head; she also cooperates by bearing down with her abdominal muscles, all the more freely because she is entirely free from pain. The delivery and subsequent repairs of any degree or duration can be completed, as long as the procaine infusion is given at the proper rate. At the end the infusion is stopped, and within a couple of minutes the patient is conscious and talks rationally and cheerfully. There is no headache, nausea or other uncomfortable sequel and no harm to the child.

This ideal result has been the rule, and the only disturbance encountered in a few cases has been in the form of convulsions. Such spasms are brief; they have subsided within a minute after stopping the infusion; there have been no danger signs in pulse or respiration and no bad consequences. The difficulty seems to be not a mere overdosage. In a certain patient the convulsions may return whenever the infusion rate is increased to the point of abolishing pain. In other words, the anesthetic threshold and the convulsive threshold are nearly

identical in such cases. No known anesthetic drug can be used without precautions, and the convulsions, though harmless in the small series to date, are recognized as a serious and conceivably prohibitive handicap to the method.

Several ways of preventing this complication readily suggest themselves, including trials of other drugs of the procaine class. It is probably never necessary to allow any patient to have an outright convulsion, because close watching will detect slight muscle quivers or twitches which give warning in ample time to stop or reduce the infusion and thus prevent trouble. Most promising at present, however, is the use of the known antidote, namely, the barbiturates. These have the additional advantage of contributing somewhat to the anesthesia, and the question is whether doses of them which are small enough to be harmless to mother and child will be sufficient to prevent convulsions in predisposed patients. The details of such dosage remain to be established, but the general question seems to be answerable in the affirmative; for at least up to the present no disturbance of any kind has occurred in patients who have received the barbiturate prophylaxis.

A few selected case records will be summarized briefly as provisional illustrations of the various methods employed:

CASE REPORTS

Case I. *Simple procaine infusion:* G. J., a colored factory worker, aged thirty-six years, was admitted at 3 P.M. with pains at ten-minute intervals and the cervix 1 cm. dilated. Her only previous pregancy six years ago had ended in abortion after two months. At that time she was found to have syphilis and received weekly treatments for over a year. A year later she had an operation for a Bartholin abscess. The medical examination revealed nothing abnormal; temperature 98.6°F., pulse 85, respiration 20, blood pressure 100/80. The pelvic measurements were normal; the fetus was in L.O.A. position with its heart rate 140.

Between 4 P.M. and 8 P.M., fairly strong labor pains occurred at two-minute intervals, and the cervix became dilated to 2 cm. Injections of 100 mg. demerol and $\frac{1}{100}$ gr. scopolamine hydrobromide were given at 6 P.M.

At 8:15 P.M. the pains continued at two-minute intervals, lasting thirty seconds, but with increased intensity so that the patient was crying loudly with them. At 8:30 P.M., infusion of 5 per cent glucose in water, containing 6 Gm. of procaine per liter, was started at a very slow rate of 0.5 cc. per minute. This very low dosage eased the pain appreciably but left the uterine contractions unchanged in time and strength. The flow was gradually accelerated to 1 cc. at 8:45 P.M. At 8:50 P.M. the pains were at one-minute intervals, lasting thirty seconds, but the pain with them was slight and easily endurable. The infusion was increased to 3 cc. per minute.

At 9 P.M. the contractions came at one-minute intervals and lasted forty-five seconds, but no pain whatever was felt with them. At 9:05 P.M. the head was visible at the vulva, and the infusion was accelerated to 10 cc. per minute. At 9:12 P.M. the baby was delivered with no pain, and the infusion was sharply slowed to 0.5 cc. per minute. Mother and child were in excellent condition. At 9:20 P.M. the placenta was expressed. At 9:30 P.M. the infusion was briefly speeded to 10 cc. per minute, allowing painless perineal repair. The infusion totalled approximately 200 cc. of solution and 1.2 Gm. of procaine in one hour.

Case II. *Simple procaine infusion:* M. McD., colored, aged twenty years, 1 para, 11 gravid, entered the hospital at 10:30 A.M. after having felt pains since 7 A.M. The medical and obstetrical examinations were normal. There were mild pains every five minutes, and the cervix was 2 cm. dilated. At 11:30 A.M. the pains had become stronger, at three-minute intervals; the cervix was 3 cm. dilated and the membranes still unruptured.

Intravenous infusion of 5 per cent glucose in water, containing 8 Gm. procaine per liter, was then started at the rate of 5 cc. per minute. At 11:45 A.M. the uterine contractions were at two-minute intervals, lasting forty-five seconds, but very slight pain was experienced with them. The membranes ruptured at 11:50 A.M. The patient was placed on the delivery table, with pains lasting forty-five seconds at one-minute intervals. The slightness of the discomfort allowed the patient to use her

abdominal muscles with unusual effectiveness. As descent occurred, the infusion was speeded to 8 cc. per minute. The patient became unable to speak but could nod her head in response to questions. Delivery was completed at 12:05 P.M. The child cried promptly and was in perfect condition. The mother stated that she remembered events during the delivery but that it had been entirely painless.

Case III. *Simple procaine infusion:* D. B., a thirty-year-old Spanish Negro housewife, para I, gravid II, developed labor pains at 6 P.M. and entered the hospital two hours later. The medical examination and pelvic measurements were normal; tests with procaine revealed no hypersensitiveness. The fetus was in L.O.A. position, and the heart beat heard in L.L.B. was 160 per minute. Active uterine contractions occurred at five-minute intervals. Bleeding in progress required a sterile vaginal examination, which revealed blood trickling from a cervical laceration.

At 8:30 P.M. the cervix was 3 cm. dilated and the membranes intact. The fetal heart and the maternal pulse were both regular, 100 per minute. The patient manifested severe suffering with the uterine contractions which came at five-minute intervals and lasted thirty seconds.

At 9:25 P.M., intravenous infusion of 5 per cent glucose in water, containing 10 Gm. of procaine per liter, was begun at a constant rate of 5 cc. per minute. At 9:30 P.M. the fetal and maternal pulse were still regular at 100 per minute. The uterine contractions were at two-minute intervals, lasting thirty seconds and accompanied by only slight pain. The cervix was 4 cm. dilated.

At 9:35 P.M. the infusion rate was accelerated to 7 cc. per minute. Uterine contractions came at one-minute intervals and lasted forty-five seconds. The patient made very slight complaint.

At 9:40 P.M. she was placed on the delivery table and the infusion was speeded to 12 cc. per minute. At 9:42 p.m. she was unable to speak but nodded her head in answer to questions; and when told to "push down," she used her abdominal muscles with exceptional effectiveness because of the total absence of pain. Her pulse was regular and strong at 105 per minute.

At 9:55 P.M. the child was delivered in excellent condition, active and crying immediately, with no sign of sensory or motor alteration from the anesthesia. The mother was bleeding freely from a cervical tear but felt no pain during the repair. She was able to speak clearly and rationally on leaving the delivery room.

The total intravenous infusion in this case was 350 cc. of 1 per cent procaine solution, given during only one-half hour. There was the usual absence of toxic symptoms or sequels.

Case IV. *Simple procaine infusion:* M. M., twenty-six-year-old factory worker, a colored primipara, entered the hospital at noon after having had labor pains since 1 A.M. The medical examination was negative. The procaine tests revealed no hypersensitiveness. The fetus was in L.O.A. position, and its heart heard in L.L.Q. was 130 per minute. Pelvic measurements were normal. Short labor pains occurred at ten-minute intervals.

At 1:30 P.M. pains were at five-minute intervals and lasted ten seconds. The cervix was 3 cm. dilated and the membranes intact. The fetal heart was 130 and the maternal pulse 105.

At 1:50 P.M., severe pains of ten seconds' duration were occurring at four-minute intervals. Infusion of 5 per cent glucose in water, containing 10 Gm. procaine per liter, was begun at the rate of 1.6 cc. per minute. Although so slight and slow, this infusion dulled the labor pains so that they were readily endured.

The patient was left with this slow infusion unsupervised until 2:55 P.M., when she was placed on the delivery table. The uterine contractions were good but only slightly painful. The fetal heart was still regular at 130 per minute, and the maternal pulse was 106.

The infusion was now accelerated to 13 cc. per minute. Within two minutes the patient was unable to speak clearly, but could understand anything said to her and in particular could cooperate by the use of her abdominal muscles. At 3:10 P.M. a healthy child was born, which was active and cried immediately. Episiotomy and subsequent perineal suture were painless, according to the patient's behavior and subsequent statement. When she left the delivery room at 3:36 P.M. there was the usual clearness of consciousness and speech and absence of headache, nausea or disorientation.

The intravenous procaine infusion in this case amounted to 400 cc. of 1 per cent solution, given during approximately one and three-

fourths hours but especially during one-half hour at the close.

Case v. *Emergency procaine infusion:* D. M., a thirty-nine-year-old white typist, I para, II gravid, entered the hospital in labor. While she was being prepared for delivery the membranes ruptured and the patient's shrieks of pain could be heard far outside the building. Intravenous infusion of a solution of 5 per cent glucose in water, containing 6 Gm. procaine per liter, was started at a rapid rate of 12 cc. per minute. Within two minutes pain was completely absent but the strong uterine contractions were unchanged. Rapid delivery was completed. The child breathed immediately and was in perfect condition. Perineal suturing then occupied about forty-five minutes. With continued procaine infusion the patient remained conscious enough to answer questions and stated that she felt no pain during the operation.

Case vi. *Emergency procaine infusion with convulsions:* C. G., a Spanish speaking colored primipara aged twenty years, was admitted at 3:30 A.M. with a history of pains for the past ten hours. She was hurried to the delivery table, crying loudly with severe, almost continuous pains. At 3:35 A.M., intravenous infusion of 5 per cent glucose in water, containing 10 Gm. procaine per liter, was started at the rate of 5 cc. per minute. The pulse was 115 per minute. Within one and one-half minutes the patient became entirely comfortable and began to sing. The pulse rate was increased to 130. There was no diminution of uterine contractions and the patient cooperated by bearing down.

At 4:09 A.M. episiotomy was performed painlessly, and delivery was completed at 4:12 A.M. The child was active and cried immediately. The placenta was delivered uneventfully at 4:18 A.M.

In preparation for repair, the infusion was speeded to a steady stream, with the result that a brief convulsion occurred. This ceased promptly upon stopping the infusion, before any antidote could be administered. The infusion was then resumed at a rate of 6 cc. per minute, permitting repair without pain. Just at the end, at 4:35 A.M., another convulsion occurred, which subsided within a few seconds after stopping the infusion. The patient recovered promptly as usual without aftereffects. The total amount of infusion was 250 cc., or 2.5 Gm. procaine, during exactly one hour.

Case vii. *Emergency procaine infusion with barbiturate:* F. M., a colored woman, aged twenty-one years, III para, was admitted at 10:45 A.M. with severe third-stage pains and was immediately placed on the delivery table. An intravenous injection of 1½ gr. of sodium amytal was given at once, and infusion of 5 per cent glucose in water, containing 10 Gm. procaine per liter, was started. The uterine contractions continued unchanged but lost all their painfulness. The patient soon passed into a semiconscious state in which she could still cooperate by bearing down with her abdominal muscles. At 10:55 A.M. an active, crying baby was delivered. The birth and the subsequent repair were painless. Stopping of the infusion brought the usual quick return of consciousness with no uncomfortable sequel.

Case viii. *Probable retardation of labor by unduly long procaine infusion; barbiturate prophylaxis in final stage:* L. D., a twenty-one-year-old colored primipara was admitted at noon, after having felt labor pains for seven hours. The medical examination was normal except for a slight apical systolic heart murmur. Hypersensitiveness to procaine was absent. The pelvic measurements were normal, and the fetus was in R.O.A. position. The maternal temperature was 98.6°F., pulse 80, respiration 20, blood pressure 110/70, and the fetal heart rate was 132.

At 2:30 P.M., moderate pains of forty-five seconds' duration were occurring at five-minute intervals. The cervix was 2 cm. dilated. The maternal pulse was 66, respiration 20, blood pressure 100/70. The fetal heart rate was 130.

At 2:45 P.M., infusion of 5 per cent glucose in water, containing 10 Gm. procaine per liter, was begun at the rate of only 1 cc. per minute. Besides the reduction of pain, there seemed to be a slight reduction of uterine contractions.

At 3:25 P.M. the pulse was 80, respiration 18, blood pressure 100/70, fetal heart 132. Uterine contractions occurred at two-minute intervals but lasted only fifteen seconds and were weaker than before. The infusion was slowed to 0.6 cc. per minute and the patient soon complained of moderate pains with the contractions.

At 4:50 P.M. the pulse was 80, respiration 18, blood pressure 110/70, fetal heart 132. Pains were now lasting forty-five seconds at one and

one-half minute intervals. The cervix was 3 cm. dilated The patient complained moderately with the pains and dozed between them. The infusion was speeded to 3 cc. per minute.

At 6:30 P M. the pulse was 80, respiration 18, blood pressure 110/70, fetal heart 132. The uterine contractions were of the same rate and duration and the cervix was 5 cm. dilated. The infusion was slowed to 1½ cc. per minute.

At 9 P.M. the pulse was 80, respiration 18, blood pressure 110/70, fetal heart 160. Pains occurred at one and one-half-minute intervals and lasted thirty seconds. The cervix was 4 cm. dilated. The infusion was discontinued, the amount given up to this time being 600 cc. with 6 Gm. procaine, during six and one-fourth hours.

At 12:05 A.M. the uterine contractions were three minutes apart, but strong and lasting forty-five seconds. The patient was crying and complaining bitterly. The procaine infusion was resumed at a rate of 2 cc. per minute. At 12:10 A.M., the contractions seemed unchanged but occasioned very little pain, though the patient was conscious.

At 2 A.M. the patient was placed on the delivery table. She was given 3¾ gr. sodium amytal intravenously, and the infusion rate was increased to 5 cc. per minute. The patient became lethargic but was able to mumble her name on request. Whenever the infusion was slowed she quickly roused and complained of "terrible pains." As soon as the rapid inflow was resumed she was again quiet. Delivery was performed painlessly with episiotomy and forceps. The baby breathed immediately and showed no sign of stupor. After painless repair of the episiotomy the infusion was stopped, and within ninety seconds the patient was clearly conscious and offered to walk to her bed, if permitted. There was the usual absence of headache, nausea, disorientation or other disturbance.

In this second period the infusion amounted to almost 400 cc., with 4 Gm. procaine, during two and one-half hours. The total given was thus approximately 1 liter of solution and 10 Gm. procaine. There was some apparent retardation and weakening of labor during the long early stage, but not during the later stage of delivery.

Case IX. *Slightly excessive barbiturate dosage:* L. M. A., an eighteen-year-old colored factory worker in first pregnancy, was admitted at 5 P.M. with pains occurring at two-minute intervals and lasting thirty seconds. The cervix was 5 cm. dilated but the membranes unruptuted. The medical and obstetric examinations were normal; pulse 85, respiration 24, temperature 99°F. The fetus was in L.O.A. position, with regular heart action 140 per minute.

At 8 P.M. conditions were similar, and the patient was excited and crying loudly with stronger labor pains. Infusion of 5 per cent glucose in water, containing 10 Gm. procaine per liter, was begun at a slow rate of 0.6 cc. per minute, the tests for hypersensitiveness having been negative. The uterine contractions remained unchanged, while the painful feelings were greatly relieved but still caused some complaints. The maternal pulse was 90, with blood pressure 118/70, and the fetal heart remained at 140. A dose of 3 gr. of nembutal was given by mouth.

At 9 P.M. the maternal and fetal conditions were unchanged. The cervix was 6 cm. dilated. The painful sensations were mild.

At 10:30 P.M. the patient was placed on the delivery table. The infusion was speeded to 6 cc. per minute, and at the same time 1 gr. of sodium amytal was injected intravenously. The patient went to sleep for five minutes, while the infusion was slowed to 0.5 cc. per minute.

At 11 P.M., as the patient began to scream with severe pains, a more rapid infusion of 6 cc. per minute was resumed. The maternal pulse was accelerated to 135 per minute but other conditions were unchanged. Episiotomy was performed and the child delivered without any pain. The subsequent repair was also painless. The child did not breathe immediately but within two minutes was in normal condition. The mother had the usual quick recovery of consciousness without headache or nausea.

The total infusion was 250 cc. of solution with 2.5 Gm. procaine in three and one-half hours. The impression was that the barbiturate prophylaxis was overdone in this case, with the unnecessary combination of nembutal by mouth and amytal by vein, and it was responsible for slight retardation of labor and perhaps for the delayed breathing of the child.

Case X. *Thyroid and cardiac complication:* L. C., a fifteen-year-old colored school girl, had been treated several times in other hospi-

tals, beginning in 1943, for diffuse toxic goiter. She had been admitted to the medical service of City Hospital three weeks previously for complaints of nocturnal dyspnea and precordial pain. Besides pregnancy, the essential findings were thyroid enlargement, basal metabolic rate plus 30, typical clinical hyperthyroid signs, systolic murmur at heart apex, slight enlargement of left ventricle on *x*-ray plates and left axis deviation in electrocardiograms. She became dissatisfied and left the hospital within a few days.

She was readmitted on the maternity service at 2 P.M. on October 11, 1945, complaining of severe labor pains which had been occurring since midnight. The pains were at five-minute intervals, lasting thirty seconds, and the cervix was 2 cm. dilated. The pelvic measurements were normal. The pulse was 112, regular, and the blood pressure 140/70. The fetus was in R.O.T. position, with heart rate 140.

The skin and ophthalmic reactions to procaine were negative. At 5 P.M., nembutal 3 gr. was given by mouth. At 7 P.M. the patient was walking about, crying loudly with labor pains which occurred at three-minute intervals and lasted thirty seconds. Her pulse was 115 and the fetal heart 132. The cervix was 7 cm. dilated. Infusion of a solution of 5 per cent glucose in water, containing 10 Gm. procaine per liter, was begun at a rate of only 1.5 cc. per minute. The pains, though not abolished, were almost immediately dulled so that the patient no longer cried during them.

At 9 P.M. the patient was placed on the delivery table. One-half gr. of sodium amytal was injected intravenously. The procaine infusion was accelerated to 3 cc. per minute. The patient soon became dimly conscious so that she could barely mutter her name on request. The infusion was then slowed to 2 cc. per minute. The pulse was 125 per minute and the general appearance good. Episiotomy was performed painlessly and a normal baby delivered. The birth and the subsequent perineal suturing were entirely painless. The patient was conscious and comfortable within a few minutes after the infusion was stopped.

The amount of the infusion was 350 cc., with 3.5 Gm. procaine, in the course of two and three-fourth hours. It did not retard labor in this young primipara or introduce any difficulty with the thyroid and cardiac complications.

Case XI. *Instrumental delivery:* A. G., a twenty-year-old white primipara, had been in the hospital two days when she began to have labor pains at 8 A.M. The medical and obstetrical examinations were normal. The temperature was 98.6°F., pulse 85, respiration 18, blood pressure 130/80. The fetus was in L.S.P. position, with heart rate 154. The usual procaine tests were negative.

At 12:30 P.M. the pains were occurring at three-minute intervals and lasting thirty seconds. The cervix was 3 cm. dilated. Infusion of 1 per cent procaine in 5 per cent glucose solution was begun at 1.3 cc. per minute. Within two minutes the previously crying patient was laughing and talking about personal matters. Slight twitching of the muscles of the left side of the face was noticed. The infusion was slowed to 0.5 cc. per minute and 1½ gr. of nembutal was given by mouth. The patient laughed occasionally but was not entirely clear in consciousness. Uterine contractions were at three-minute intervals, of 45 seconds' duration, and were almost painless.

At 2 P.M. the patient was placed on the delivery table, and was given ¾ gr. of sodium amytal intravenously. The infusion rate was increased to 14 cc. per minute, and after two minutes slowed to 2 cc. per minute. The uterine contractions continued unchanged but were painless. The maternal pulse was 100, the fetal heart 160. The infusion was again speeded to 12 cc. per minute as a breech delivery was effected. There was difficulty and delay with the head, which was finally delivered by forceps. The child was feeble in crying at first, but after five minutes was in good condition.

At 2:30 P.M., with the infusion slowed to 0.3 cc. per minute, the placenta was delivered. The infusion rate was then increased to 13 cc. for the purpose of a difficult suture of the cervix, which altogether occupied two hours. The pulse remained at 105, the blood pressure 130/80. The patient felt no pain and made the usual quick recovery, so that she was able to assist herself from the delivery table to the stretcher.

Case XII. *Instrumental delivery:* E. R., an eighteen-year-old colored primipara, entered the hospital at 8 A.M. with labor pains at ten-minute intervals, which she said had started at 9:30 the previous evening. The temperature was 98.6°F. pulse 87, respiration 23, blood

pressure 118/70. The general findings and also the procaine sensitiveness tests were negative. The fetus was in R.O.A. position, with heart rate 140.

At 8:30 A.M. pains lasting forty-five seconds were occurring at three-minute intervals. The cervix was 4 cm. dilated. The patient was given 1½ gr. of nembutal by mouth.

At 8:45 A.M. infusion of 5 per cent glucose solution in water, containing 10 Gm. procaine per liter, was started at the rate of 1 cc. per minute. The uterine contractions continued at the three-minute rate and lasted one minute. The maternal pulse was 85, the fetal heart 140. The painful sensations were reduced so as to be easily bearable, the patient remaining clearly conscious.

At 9:40 A.M. the patient was placed on the delivery table and the infusion was accelerated to 11 cc. per minute. The result was the usual dimming of consciousness and complete absence of pain, while strong uterine contractions of one minute's duration occurred at one-minute intervals. Sodium amytal gr. ¾ was injected intravenously and the same rate of infusion was continued, while episiotomy was performed and a vigorous crying child delivered painlessly with forceps.

The infusion was then slowed to 0.3 cc. per minute and the placenta was delivered at 10:15 A.M.

A more liberal use of barbiturate being now unobjectionable, an injection of 2 gr. sodium amytal was given intravenously. The infusion rate was increased to 13 cc. per minute, during two hours which were occupied with suturing of the cervix and perineum. With the usual quick recovery of consciousness, the patient was able to talk while being moved from the delivery table, and there was the usual absence of after-effects.

SUMMARY AND CONCLUSIONS

With intravenous procaine infusions, two grades of obstetrical analgesia are obtainable, provided rare cases of hypersensitiveness are excluded by tests.

Small dosage, not sufficient to cause dizziness or other subjective symptoms, can dull the pains especially during the second stage of labor, so that they are much more easily endurable. This effect is interpreted as being wholly or chiefly on the peripheral nerves. It fails to give much relief during third-stage delivery and subsequent repair operations. The advantages are the considerable alleviation of suffering, with convenience and complete safety.

Larger dosage, by an apparent central action, induces a state of dim consciousness in which the patient is more or less unresponsive but retains some awareness and memory of events. Touch sensations may persist but anesthesia, in the strict sense of absence of pain, can be maintained during delivery and any necessary operations.

The only difficulty encountered thus far has been the occasional liability to convulsions. These have not been disastrous and can apparently be prevented by preliminary administration of barbiturates.

The advantages are the convenient, flexible and rapidly controllable anesthesia, the non-interference with uterine contractions in the active stage, and the almost immediate recovery without headache, nausea, disorientation or other after-effects. The apparent safety for both mother and child still requires confirmation by larger experience, but the method is now routine in this hospital.

If the present hopes and indications are fulfilled, the method may furnish a solution of the immemorial problem of saving women from the pangs of childbirth.

Appreciation must be expressed especially to Dr. Kenneth Johnson, in charge of the obstetrical service, and to other staff members of the City Hospital. Without their cooperation in a surviving free institution, an independent research of this character would unquestionably have been suppressed for years, by the same control which delayed the development of surgical refrigeration and prevented its military adoption. Acknowledgment is also due to Dr. C. R. A. Gilbert, medical resident, who conducted the anesthesia in this series of cases.

REFERENCES

1. Allen, F. M. Intravenous procaine analgesia. (In press.)
2. Lundy, J. S. Clinical Anesthesia. Philadelphia and London, 1942. W. B. Saunders Co.
3. Gordon, R. A. Intravenous novocaine for analgesia in burns. *Canad. M A. J.*, 49: 478–481, 1943.
4. McLachlin, J. A. The intravenous use of novocaine as a substitute for morphine in postoperative care. *Canad. M. A. J.*, 52: 383–386, 1945.

SURGICAL MANAGEMENT OF FEMORAL VEIN THROMBOSIS*

EUGENE L. LOWENBERG, M.D.

Chief of the Peripheral Vascular Disease Clinic, Norfolk General and De Paul Hospitals

NORFOLK, VIRGINIA

THERE are five clinical forms of femoral vein thrombosis:

1. *Bland Thrombosis* of the deep veins of the calf. This is the phlebothrombosis of Homans. There is pain in the foot or calf, accompanied by local tenderness, pain in the calf on dorsiflexion of the foot (Homans' sign), slight elevation in temperature, a moderate increase in the sedimentation rate and the leucocyte count. This form is initiated in the lower leg and is the predecessor of the other thrombotic femoral processes in most instances. It has serious embolic possibilities, being non-obstructive, non-adherent and tending to propagate. It is the form for which prophylactic superficial femoral vein ligation is being extensively advocated.

2. *Acute Femoro-iliac Thrombophlebitis.* This is phlegmasia alba dolens or acute milk leg and the completely obstructing inflammatory femoro-iliac disease of Homans. It results from the propagation of a thrombus in a deep calf vein into the femoral and iliac as a completely obstructing adherent solid clot with consequent complete cessation of venous flow and marked inflammation of the vein wall. There is swelling of the leg from foot to groin, generalized pain in the extremity, local tenderness and pain in the femoral triangle, considerable elevation of temperature, increase in sedimentation rate and leucocyte count. So great is the inflammation that the surrounding lymphatics are involved in the perivenous exudate and the adjacent femoral artery is thrown into spastic contraction. Irritating impulses from the involved area cause marked reflex peripheral vasoconstriction, increasing further the edema and vascular disturbances. Embolism is rare in this form because the thrombus is firmly adherent to the inflamed vein wall. Surgical attack is not indicated. Marked benefit is obtained by releasing the reflex peripheral vasoconstriction by paravertebral novocaine injections of the lumbar sympathetics. This form is to be distinguished from the chronic incompletely obstructing bland femoro-iliac disease described in section 4, which has dangerous embolic possibilities and which requires surgical intervention.

3. *Lower Femoral Propagating Thrombus.* A propagating thrombus from a deep vein of the calf has extended through the popliteal and dangles dangerously in the lower femoral. Although this is the state which most commonly leads to pulmonary embolism and which is amenable to simple surgical attack through femoral exploration, it is accompanied by no characteristic signs and symptoms, and we have no adequate descriptive name for it. Unfortunately, the unattached propagating mass in the popliteal or lower femoral adds nothing to the clinical picture to indicate its presence. One can only infer that such a state may exist in any case of lower leg bland thrombosis which does not quickly subside, or in any instance of pulmonary embolism. Lower femoral propagating thrombus is an urgent indication for interruption of the common femoral and should embolism have occurred, bilateral femoral division is the only safe procedure.

4. *Chronic or Subacute Femoro-iliac Bland Thrombosis.* This is the incompletely

* From the Peripheral Vascular Clinic of Norfolk General Hospital.

obstructive bland femoro-iliac thrombosis of Homans. It results from the propagation of a deep thrombosis in the calf into the

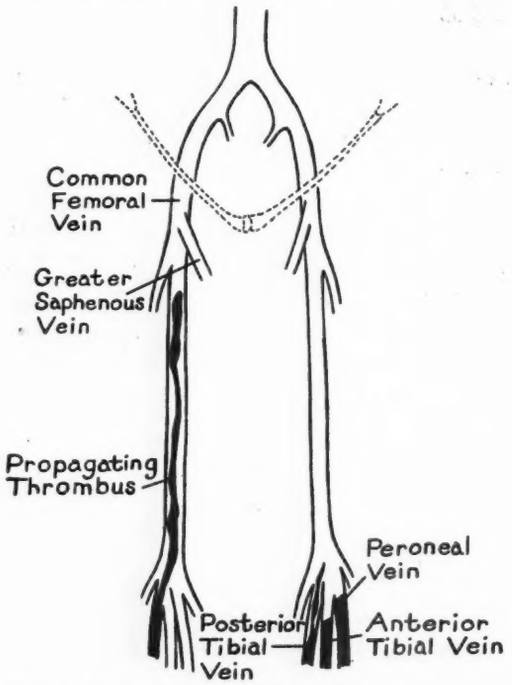


FIG. 1. Left, phlebothrombosis of the deep veins of the lower leg. The process may heal in site, propagate upward or detach and form an embolus. Right, a propagating thrombus dangles in the femoral with imminent danger of embolism. (Modified from Homan's in *Surg., Gynec. & Obst.*)

femoral and iliac vein in the form of a non-obstructive, non-adherent clot. Whereas the site of the disease is essentially the same as that of acute femoro-iliac thrombophlebitis or milk leg, the obstructive and inflammatory factors are absent with resultant dearth of signs and symptoms and increased danger of embolism. The disease may be suspected when evidence of bland thrombosis of the deep veins has persisted unduly long (several weeks) or when embolism has occurred. According to Homans a rather characteristic sign of this advanced extensive type of bland thrombosis is lower leg cyanosis when the patient is allowed to stand up a minute or so. The cyanosis is due to extensive involvement of the collateral channels as well as to involvement of the femoral and iliac vein in the thrombotic process. In this form the profundal branch is frequently partially thrombosed and secondary thrombosis of the saphenous or its superficial branches occurs. Other signs of bland incompletely obstructive femoro-iliac thrombosis are persistent edema, usually confined to the ankle and lower leg in the bedridden patient, and slight thickening about the femoral vessels in the groin, so that the arterial pulsation at the point is indistinct. In bland incompletely obstructive femoro-iliac thrombosis, since blood continues to flow, the proximal end of the propagating mass may readily detach, producing recurring embolic episodes. Surgical treatment has customarily consisted of extraction of the clot through the opened femoral vein. As referred to later, Homans has recently advocated attacking this form of the disease at the common iliac rather than the femoral level.

5. Pulmonary Embolism. This is included as a fifth clinical form of deep vein thrombosis, because the first indication of deep vein thrombosis may be, and often is, pulmonary infarction. In practically all instances, except the few cases arising from the pelvic veins or the right side of the heart, the embolus has come from deep veins of the lower extremities. Pulmonary infarction calls for immediate careful study of the legs. One may find the deep calf tenderness and slight edema of lower leg phlebothrombosis, the cyanosis, ankle edema and groin thickness of incompletely obstructive femoro-iliac disease, or the legs may be entirely normal to inspection and palpation. It is well to emphasize that the legs may show none of the usual signs and symptoms of thrombosis and yet be the source of the offending embolus. Venography has demonstrated this time and time again, and one may well convince oneself of the fact by taking venograms in a few such cases. The preferable and safest procedure is to ligate the common femoral on both sides, when pulmonary infarction has occurred, in the absence of obvious cause other than the legs. Contrarily, should inspection of the legs reveal the generalized edema and femoral tenderness

of acute femoro-iliac thrombophlebitis or milk leg, one should remember that this is usually a completely obstructive, adherent affair, and is not the likely source of the embolus. In all probability, the deep veins of the opposite leg are at fault, even in the absence of local signs and symptoms, and the femoral of the opposite leg as well as that of the clinically affected one should be surgically attacked.

THE COURSE OF BLAND THROMBOSIS

As practically all instances of femoral thrombosis begin in the deep veins of the calf, one may well review the subject by describing the various courses which bland thrombosis may follow: (1) The initial thrombus, having formed in the deep veins of the calf, may remain as a local process and there heal without complications or sequelae; (2) part or all of such a thrombus may become detached and form an embolus; (3) the initial thrombus may progress through the popliteal to obstruct fully the femoral and external iliac vein causing the acute obstructive inflammatory disease, phlegmasia alba dolens or milk leg, (4) the process may extend through the popliteal as a soft propagating non-adherent, non-obstructive clot floating in the lower femoral with imminent danger of embolism, and (5) the initial thrombosis may advance into the upper femoral and the iliac or even into the vena cava becoming adherent here and there to the vein wall, but complete obstruction does not occur and a current of blood persists, which may wash free the proximal end of the mass. This again is the chronic femoro-iliac bland thrombosis or incompletely obstructive femoro-iliac embolus threatening disease.

The Rationale of Surgical Intervention. From the foregoing, it is clear that surgical intervention in thrombotic disease of the veins of the lower extremity may hope to accomplish the following: (1) Prevent pulmonary embolism in the presence of bland thrombosis of the deep veins of the calf; (2) prevent pulmonary embolism in the presence of the quiet, non-obstructive thrombosis in the popliteal and lower femoral; (3) prevent recurring embolic episodes when the incompletely obstructive femoro-iliac thrombotic state exists; (4) further the subsidence of acute femoro-iliac thrombophlebitis or milk leg which has not responded to conservative measures. Local extraction of the clot and local resection of a segment of the vein hasten the resolution of the process in selected instances; (5) lessen the incidence of acute femoro-iliac thrombophlebitis or milk leg by limiting the thrombotic disease to the veins below the femoral.

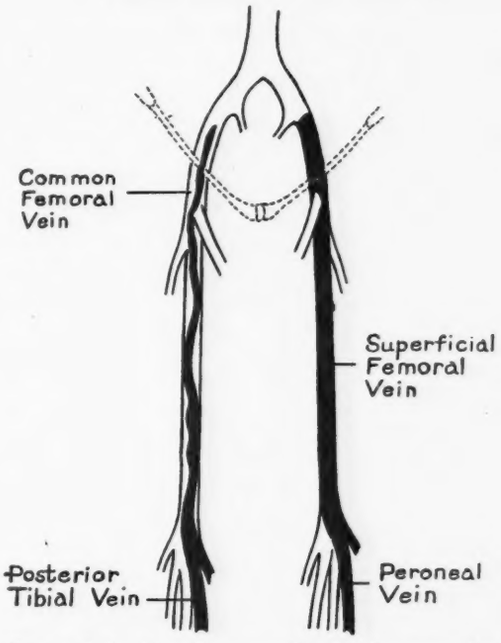


FIG. 2. Left, thrombus completely obstructs the femoral and lower iliac, causing the acute inflammatory process, phlegmasia alba dolens. Right, the thrombus has occupied the femoral and the lower iliac, but is only partly adherent and non-obstructive. This chronic or subacute form of phlebothrombosis is diagnosed with difficulty, there being only slight edema about the ankle, some cyanosis and some thickness of the vascular sheath in the groin. It is a frequent cause of embolism.

Indications for Surgical Intervention. (1) Pulmonary embolism with demonstrable signs and symptoms in the lower legs; pulmonary embolism without demonstrable signs and symptoms in the legs with positive venography evidence of deep vein thrombosis. The surgical intervention

should be bilateral in most instances. (2) Pulmonary embolism in the presence of acute phlegmasia alba dolens or milk leg.

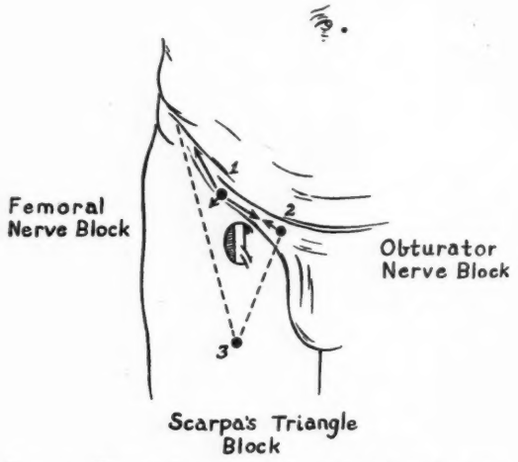


FIG. 3. Femoral vein exploration: Local anesthesia for femoral vein exploration. 1, point for femoral nerve block; 2, point for obturator nerve block; 3, apex of Scarpa's triangle.

As previously mentioned, the surgical attack is bilateral for the opposite leg may be the source of the embolus in such instances. (3) All cases of incompletely obstructive propagating lower femoral or femoro-iliac phlebothrombosis, diagnosed before or after embolism has occurred. (4) Leg amputation in the aged. Femoral vein ligation preliminary to the amputation prevents the most common cause of death in these cases.

Bland Thrombosis of the Deep Veins of the Calf. As we have no way of knowing which process will remain local and which will detach, ideally we should ligate the femoral in 100 per cent of such cases. And this is the practice of many clinics. However, as a certain and fairly good percentage of cases do heal *in situ* without complications, and as the age of the patient seems to be an important factor, the young being less likely to have, and better able to survive an embolism than the aged, conservatism may at times be practiced. Statistics suggest that after the age of forty the thrombus is more likely to propagate and embolism is more apt to occur. Our present practice is to interrupt the femoral vein in all instances of bland thrombosis of the calf veins in patients over forty years of age, in all instances of bland thrombosis of the calf in patients under forty years of age which do not show signs of rapid healing, and in all instances of bland thrombosis of the calf veins in the presence of pulmonary embolism, irrespective of age.

OPERATIVE TECHNIC OF FEMORAL VEIN LIGATION

Anesthesia. Low spinal anesthesia is preferable if there are no pertinent contraindications. Local infiltration, using 1 per cent novocaine for the skin and ½ per cent novocaine for the deeper tissues is fairly satisfactory. Field block of Scarpa's triangle, supplemented by femoral nerve and obturator nerve block is the most effective method. The details are as follows:

Femoral Nerve Block. A needle is introduced 1 cm. lateral to the femoral artery just below Poupart's ligament. The needle is advanced in a direction perpendicular to the skin surface until it reaches Scarpa's fascia. It is then advanced 1 cm. deeper and as soon as parasthesia is obtained, 5 cc. of 2 per cent novocaine solution are injected.

Obturator Nerve Block. A wheal is raised just below and just lateral to the pubic spine. The needle is advanced perpendicular to the skin surface until it impinges on the horizontal ramus of the pubis. It is then withdrawn a little, its shaft bent inward and about 30 degrees downward and advanced until the needle point comes in contact with the upper wall of the obturator canal. The needle is then advanced outward, backward and upward about 2 cm. further into the obturator canal and about 10 cc. of 1 per cent novocaine solution are injected.

Field Block of Scarpa's Triangle. One-half per cent novocaine solution is infiltrated subcutaneously over Poupart's ligament from the anterosuperior spine of the ileum to the spine of the pubis, and from the apex of Scarpa's triangle upward

along the sartorius muscle laterally and the adductor muscles mesially.

Incision. A vertical incision is made over the femoral artery pulsation beginning just above the crease in the groin and extending downward for about 5 cm., on a line with the adductor tubercle of the femur. When the femoral pulsation is undetectable because of spastic contraction of the artery or because of thigh edema, the approximate location for the incision may be ascertained by noting the position of the femoral artery of the opposite leg.

Procedure. The deep landmarks are the sartorius muscle laterally, the pectineus muscle mesially, and the vascular sheath as it bisects Scarpa's triangle. No important structures are encountered until the femoral artery is reached. If the saphenous vein or its lateral superficial femoral branch is encountered, it is simply retracted mesially or laterally. The femoral artery lies anterior to and approximately on top of the femoral vein. The incision is deepened rapidly through the subcutaneous fat, through the thin Camper's fascia, more fat and then through Scarpa's fascia onto the femoral sheath. If the thrombotic process has extended into the femoral vein, the pulsation of the femoral artery may be too faint to serve as a guide for the dissection. In such instances one deepens the wound to the pectineus muscle mesially or the sartorius muscle laterally. The vascular sheath will be found just deep to the inner border of the sartorius or anterior and lateral to the pectineus.

Once the vascular sheath has been located, one may increase the length of the artery exposed by cutting freely the roof of Scarpa's triangle in the direction of the vessel. If the dissection is high in the triangle, the artery may be sufficiently lateral to the vein for one to incise the vascular sheath directly over the femoral vein. Usually the femoral vein is completely hidden by the overlying artery. It has been my practice to incise the sheath over the artery and to apply small clamps to the mesial edge of the divided sheath to retract the artery laterally. The vascular sheath is then again incised mesially and more deeply exposing the femoral vein.

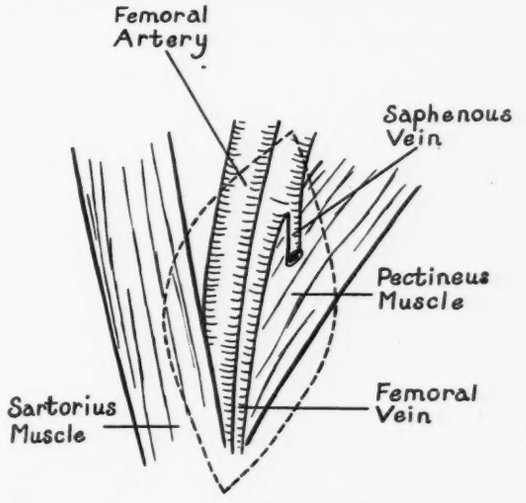


Fig. 4. Femoral vein exploration: The deep landmarks for the femoral vein exploration. In this technic the femoral arterial pulsation is the guide. No important structures exist anterior to the vascular sheath, and the dissection is directly onto the femoral artery.

The femoral vein is dissected free within its sheath from the femorosaphenous level above to the profunda branch below. Several posterior and posterolateral branches are encountered and these must be carefully ligated and divided. Premature attempts to pass an aneurysmal needle or a ligature under the femoral vein may tear one of these posterior branches or even the profunda femoris, resulting in troublesome hemorrhage.

Approach to the Femoral Vein through the Foramen Ovale. Instead of the above described direct dissection, the femoral vein may be approached through the foramenal ring at the femorosaphenous junction. The saphenous is dissected upward to its femoral junction. The saphenous is then divided and retracted upward to expose the foramen ovalis. A tiny, but vigorously pulsating artery, the external pudendal, is seen and divided between ligatures as it passes over the lower rim of the foramen. A curved clamp is insinuated under the foramenal rim into the femoral sheath and the rim and sheath incised. The femoral vein is thus exposed

within its compartment of the vascular sheath; there is less need for handling the artery, and less disturbance of the lymphatics. Although time is lost in the upward dissection of the saphenous, there is no search for the femoral vein. Furthermore, one can be sure that the femoral exploration is high—above the profunda. The needless loss of time, extra dissection, and sacrifice of the saphenous have caused me to use this approach less frequently.

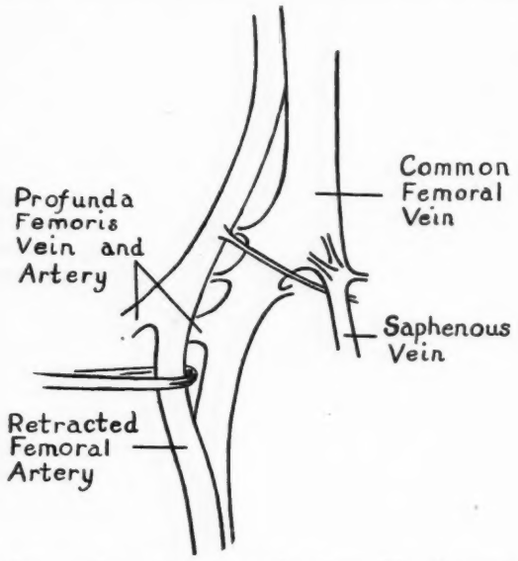


FIG. 5. Femoral vein exploration: The femoral artery must be separated from the vein and retracted laterally. The branches of the femoral vein at the site of exploration must be ligated and divided.

Exploration of the Femoral Vein. Once exposed, the femoral vein may be explored between the profunda branch and the saphenous, i.e., in the common femoral or below the profunda, i.e., in the superficial femoral. The higher level is the site of election. Interruption of the vein at this level obviates any danger of embolism from an unsuspected clot in the profunda and exploration here may result in successful extraction of a clot from the upper femoral or even the iliac. However, as ligating the femoral above the profunda occasionally causes considerable thigh edema, one is justified in performing "below the profunda ligation," when the pathological process is still restricted to the lower leg, as in prophylactic ligations for uncomplicated phlebothrombosis of the calf veins.

One might perform more "below the profunda" explorations if adequate criteria were available for determining the extent of the thrombosis. There is little about the appearance of an exposed femoral vein that indicates the state of affairs within its lumen. If the femoral artery is in a state of spastic contraction, the adjacent vein is apt to have a thrombus within its lumen; if the vein wall is altered or the vessel markedly dilated or contracted, intraluminal thrombosis probably exists. At the level of exploration, if the saphenous is divided with the head of the table elevated, absence of free flow of blood from above suggests obstruction of the femoral at a high level.

After a 3 or 4 cm. length of the femoral vein has been freed from its sheath and all pertinent branches ligated and divided, the vein is ready for exploration of its lumen. Ligatures are passed but not tied around the vein above and below the selected site of exploration and the anterior vein wall is cut open between two small clamps. The field is kept clear by suction. A swab culture of the vein lumen is made. If there is a free flow of blood from the incised femoral and no clot within its lumen, the previously placed ligatures are tied and most of the segment of vein between the ligatures is resected. Excision of a portion of the vein is important as it tends to interrupt the reflex peripheral vasoconstriction. The vein stumps are elevated to make sure no branches enter them distal to the ligatures lest postoperative bleeding occur, and additional ligatures are placed around each stump for safety.

If the lumen is completely obstructed by clot, sufficient clot must be extracted from each end to permit ligation of the collapsed vein. This condition will rarely be found as it only occurs in acute femoro-iliac thrombophlebitis or milk leg, for which condition femoral exploration is rarely performed.

If a partly organized, partly obstructing and loosely adherent thrombus is found, it may be grasped with a small stone forcep and slowly extracted from the upper femoral or even from the iliac vein. It is wise to elevate the head of the operating table during this extraction. This may prevent an unattached clot from ascending in the iliac and the downward flow of blood may even wash out through the opened vein small fragments of clot left behind during the extraction.

If the thrombus does not come out in one piece, or if the vein lumen is occupied by grumous partly clotted material, one may attempt to clear the vein by suction. The head of the table has been previously raised. A curved suction tube is inserted into the opened vein and suction applied above with the vein clamped off below. Simple glass drinking tubes, curved at the end, are suitable for this purpose. Several sizes should be available, lest the tube be too large to get into the vein lumen or too small for adequate suction. Suction should be continued at low pressure until a free flow of normal blood is obtained. The vein is then ligated above and below and a segment resected as previously described. Suction thrombectomy is most apt to be successful when the femoral exploration is performed early, before organization and adherence have had time to develop.

The above procedure is subject to certain theoretical and practical objections: The introduction of the suction tube into the upper femoral may dislodge a clot and promote embolism. One has no way of being sure the tail of the thrombus has been removed, and the operative procedure is through, rather than above the pathological process, with possibility of thrombosis recurring above the ligated segment. Such considerations have led Homans and Veal to discontinue the suction procedure. In the circumstances under discussion these authors would close the femoral triangle incision and proceed at once under general or spinal anesthesia to explore the common iliac vein through a retroperitoneal inguinal incision.

Closing the Wound. As the femoral vein exploration has necessitated dividing lymphatic vessels which may harbor bacteria and as the vein itself may show a positive culture, I have habitually flushed the wound with 0.8 per cent sulfanilamide solution. The solution is less irritating than the powdered drug. I believe the procedure has lessened wound infection. The deep fascia and the subcutaneous fat are re-united with a few interrupted sutures and the skin closed without drainage.

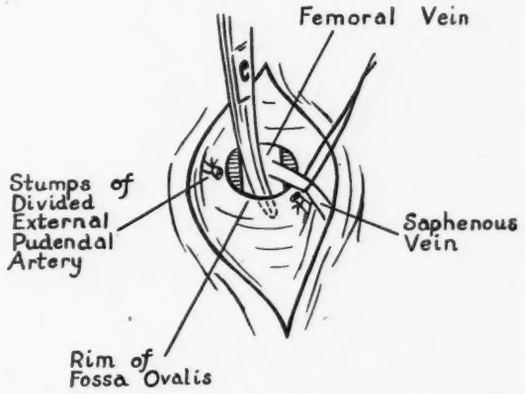


Fig. 6. Another method of approaching the femoral vein. The saphenous vein is the guide. A clamp is inserted into the vein compartment of the femoral sheath through the fossa ovalis at the femorosaphenous junction.

COMMON ILIAC EXPLORATION

The disadvantages and dangers of femoral exploration in the presence of a propagating thrombus in the upper femoral have been previously described. By attacking the problem at the common iliac level, the vein may be interrupted almost invariably above the pathological process. Furthermore, as recently emphasized by Homans, when the common femoral and its collateral channels are involved in thrombosis, there is less interference with circulation from common iliac than from common femoral division. This is so because of the extensive collateral circulation provided by the hypogastric vein and its branches. However, common iliac vein exploration carries with it the added

danger of general or spinal anesthesia in critically ill patients. The retroperitoneal exposure is not easy, the dissection may be

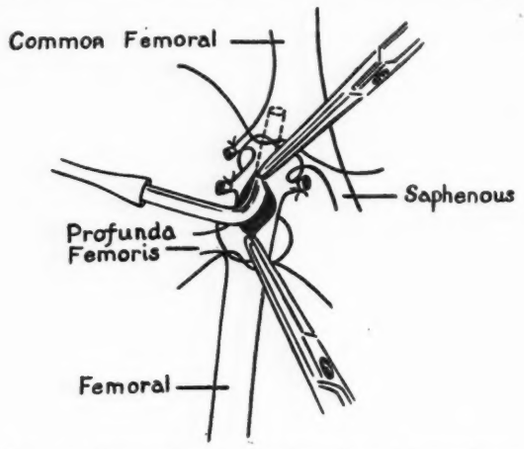


FIG. 7. Femoral vein exploration: Illustrating removal of clotted and partly clotted material from the femoral and lower iliac by suction.

through hypertrophied and infected lymphatics, with resultant danger of wound infection. There is danger of tearing the iliac vein in dissecting it free from the artery. Homans reports six right iliac sections and eight left-sided operations. Shackelford and Whitehill report a case of ligation and division of the left common iliac after extracting a soft thrombus that was propagating from the iliac into the vena cava. Common iliac exploration is performed through an oblique inguinal incision commencing in the flank and extending to the level of the external inguinal ring, parallel to the inguinal ligament. On the right side, the common iliac vein is lateral to the artery and fairly accessible. On the left side the vein is mesial and deep to the artery and extensive freeing and retracting of the artery is required to expose the vein. High dissection, exposing the vena cava is advisable and the vein section should be above the hypogastric branch.

POSTOPERATIVE CARE

After femoral or iliac vein exploration, measures should be instituted to limit postoperative leg edema. These include elevation of the leg on an inclined plane, limitation of fluids, restriction of salt intake, high protein diet, warm compresses from foot to groin. Diuretics may be given by mouth or a mercurial diuretic by vein. The sulfa drugs may be ordered for a few days as a prophylactic against wound infection. Heparin and Dicoumarin may be considered if recurrence of thrombosis or extension of the thrombotic process is feared. Several days postoperatively the leg is lowered to bed level, and the patient is allowed out of bed on the sixth or seventh day. A 4 inch Ace No. 8 leg bandage should be worn until all tendency to edema is gone. The swelling is in proportion to the extent of the thrombophlebitic process rather than as the result of vein section. Section of an uninvolved femoral is followed by inappreciable edema.

CASE REPORTS

CASE I. P. H. Norfolk General Hospital No. 9674. Nephrectomy for pyonephrosis was performed on a twenty-six year old male. Signs of phlebothrombosis of calf veins appeared seven days postoperatively and pulmonary embolism seventeen days after onset of evidence of deep vein phlebothrombosis. Three weeks later when all signs in the leg had disappeared, a second episode of pulmonay embolism occurred. Venogram showed a filling defect in the lower femoral. At operation the femoral was explored below the profunda and found to be free of clot. "Below the profunda" ligation and resection was performed. The patient made an uneventful recovery and no further embolic episodes occurred.

Comment. It is unusual for a clot to detach seventeen and forty-one days after the onset of the phlebothrombosis. At the time of the femoral exploration, there was nothing about the leg to indicate it was the source of the emboli. Only the history of preceding calf pain and tenderness and the venogram gave the clue to the surgical procedure necessary to prevent further embolic episodes.

CASE II. A. R., Norfolk General Hospital No. 4697. A supravaginal hysterectomy in a thirty-five-year old woman was followed on

the tenth postoperative day by phlebothrombosis of the deep calf veins. Fourteen days later, about twenty-four hours after paravertebral novocaine injection of the lumbar sympathetics, pulmonary embolism occurred. At operation the femoral artery was a spastically contracted cord resting on top of the vein. The femoral vein was almost completely thrombosed. A red clot partially occluding the vein lumen was extracted, and a segment of vein resected between ligatures. Convalescence was uneventful.

Comment. Interruption of the sluggish current of blood still flowing through the partially occluded vein was beneficial in addition to the successful thrombectomy. No further embolism occurred.

CASE III. B. M., Norfolk General Hospital No. 8636. A thirty-year old female was admitted with signs and symptoms of extensive bilateral pneumonia and a violent thrombophlebitis involving the varicosed right saphenous. The patient was discharged as well fifteen days later, although a patch of redness over the saphenous in the thigh was still present. The patient was re-admitted four days later with pulmonary embolism. The only sign present in the lower extremities was a dull brownish discoloration along the entire course of the previously inflamed saphenous. A venogram was interpreted as showing extensive phlebitis involving the anterior and posterior tibial and femoral vein. At operation a canalized thrombus was found forming a thin rim around the lumen of the common femoral. The common femoral was divided between ligatures. On the fourth postoperative day an episode of dyspnea and coughing occurred, and the physical signs in the chest suggested another embolic attack. Thereafter the patient made an uneventful convalescence.

Comment. It is well known that a latent deep vein thrombosis often co-exists with a thrombophlebitis of the saphenous system. The embolism occurring after the femoral exploration may have resulted from a clot in the femoral above the site of exploration or from the opposite leg. Bilateral femoral ligations should be performed when embolism has occurred.

CASE IV. B. J., Norfolk General Hospital No. 6570. A seventy-five-year old male was seen in consultation. His physician stated he had had clinical evidence of pulmonary embolism several days previously. The right leg was edematous from toes to groin and there was a patch of redness and tenderness on the dorsum of this edematous foot. There was a cyanotic hue to the entire leg. There were pain and tenderness in the calf of the opposite leg, and a positive Homans' sign. A diagnosis of subacute non-obstructive femoro-iliac thrombophlebitis in the right leg and phlebothrombosis of calf veins in the left leg was made. At operation the right femoral artery was spastic, and the subjacent vein filled with dark grumous partly clotted blood. The clotted and semi-clotted material was removed by suction and the vein sectioned. The left femoral vein lumen was free of pathological findings. It was likewise sectioned. The patient made an uneventful convalescence.

Comment. The femoral exploration was performed twenty-three days after the onset of deep vein thrombosis in the right leg. The semi-organized thrombus found at operation would suggest that the patient was in grave danger until the vein was emptied of clot and sectioned.

CASE V. A. C., Norfolk General Hospital No. 8852. The patient was first seen fifteen days subsequent to a supravaginal hysterectomy with signs and symptoms of phlebothrombosis in the left calf. Prophylactic femoral vein ligation was advised and performed. At the site of exploration in the groin the femoral vein was normal. Several days after the patient's discharge from the hospital, the signs and symptoms of pulmonary embolism suddenly occurred. The patient was re-hospitalized. Pain and tenderness in the calf and a positive Homans' sign were now present in the unoperated (right) leg. No signs were elicited in the femoral region and the thigh was not edematous. At femoral exploration an organized grayish cylindrical partly adherent thrombus was found and readily extracted *en toto*. Free flow of blood occurred from the upper vein thereafter. Convalescence was uneventful. No further emboli occurred.

Comment. A study of the record disclosed that this patient had a slight rise in

temperature the day of her first discharge from the hospital and complained of pain in the right calf. Bilateral deep vein involvement occurs very frequently.

Case vi. M. W., Norfolk General Hospital No. 7451. Several days after her discharge from the hospital following a cholecystectomy, a forty-eight-year old female developed signs of pulmonary embolism. On re-hospitalization the left calf was tender and swollen. Symptoms and signs developed in the groin before exploration was decided upon. At exploration the common femoral contained soft, partly clotted material. This was readily removed by suction, and a good flow of blood was obtained from above. The common femoral was sectioned. The patient made an uneventful convalescence.

Comment. In this instance the iliofemoral process was not completely obstructive and not completely adherent and the operative interference was probably life-saving. Some risk was taken by not likewise sectioning the femoral of the opposite leg.

Case vii. B. W., Norfolk General Hospital No. 8193. A sixty-three-year old woman had a cholecystectomy and common bile duct exploration. Approximately twenty-four days postoperatively signs and symptoms developed of embolism in the right chest. Thirteen days later signs and symptoms of phlebothrombosis in the left calf were discovered. Three days later the left common femoral was explored. The vein was incompletely, but rather fully occupied by a soft red poorly organized clot. It was possible to extract all of the clot by suction, and obtain a good flow of blood from above. The common femoral was then doubly ligated and divided. The day following the operation the patient developed an episode of acute pain in the left chest which was attributed to a small embolus. From then on the patient made an uneventful recovery.

Comment. It is probable that the postoperative embolism which occurred the day after the femoral exploration came from a clot that was not removed from the upper femoral at the vein exploration or from a process in the deep vein of the opposite leg. It would have been safer to have closed the groin wound and to have done a common iliac section well above the thrombotic process.

Case viii. H. L., Norfolk General Hospital No. 18254. A forty-six year old male suddenly developed pain in his right calf while apparently in good health and leading a normal life. A diagnosis of phlebothrombosis of the calf vein was made by his family physician and the patient was kept in bed and treated medically. Three weeks after the onset of his illness he suddenly developed pain in his right chest. He subsequently experienced periodic embolic episodes. The patient was sent to the Norfolk General Hospital by ambulance. There was nothing to indicate a thrombotic disease of the lower extremities but in view of the history it was decided to explore first the right femoral and subsequently the left, if necessary. Upon operation the femoral artery was contracted and spastic. Below the profunda branch the femoral vein was enormous and firm, and on opening its lumen it was found to be almost completely obstructed by greyish thrombus. Above the profunda the femoral was about normal in size and partly occluded by a reddish thrombus. There was a persistent flow of blood through the vein from the profunda branch. The common femoral was divided between ligatures after the clotted material had been removed by suction. Convalescence was uneventful.

Comment. A diagnosis of deep vein thrombophlebitis as the cause of the patient's embolic episode was made on information given by his family physician. At the time of the patient's hospitalization, both extremities were normal clinically. It was remarkable to see the femoral so actively involved in a thrombotic process without any local signs. In this case, apparently the flow of blood from the profunda was washing upward the thrombus as it protruded from the superficial femoral into the common femoral.

Case ix. F. H., Norfolk General Hospital. A forty-nine-year old man was hospitalized because of suppuration of the soft part of the right wrist following an accident. In the third week of this illness pain and tenderness developed in the left calf and a positive Homans'

sign. Several days later the varicosed saphenous vein on the right became inflamed. Subsequently signs of phlebothrombosis of the deep calf veins of this leg were elicited. The patient was treated conservatively and was discharged symptom-free about two weeks later. On his sixth day home, he suddenly experienced substernal pain, dyspnea, and anxiety. A diagnosis of a small pulmonary infarction was made. The next day a bilateral common femoral vein exploration and division were performed. The vein was normal at the site of exploration. No further embolic episodes occurred.

Comment. The danger of embolism in phlebothrombosis in patients over forty is again emphasized. The co-existence of superficial and deep thrombophlebitis is illustrated.

SUMMARY

Homans' clinical forms of femoral vein thrombosis are reviewed. Indications for surgical intervention are given. Two approaches to the femoral vein are described and details of the operative procedure in thrombotic disease given. Femoral vein ligation for prophylactic purposes in the absence of embolism is debatable. Femoral vein exploration remains the treatment of choice once embolism has occurred and there is clinical evidence of thrombosis in the deep veins of the lower extremity.

REFERENCES

1. BARKER, NELSON W., CROMER, HORACE E., HURN, MARGARET and WAUGH, JOHN M. The use of Dicumarol in the prevention of postoperative thrombosis and embolism with special reference to dosage and safe administration. *Surgery*, 17: 207–216, 1945.
2. BARKER, N. W., NYGAARD, K. K., WALTERS, WALTMAN and PRIESTLEY, J. T. *Proc. Staff Meet., Mayo Clin.*, 16: 33–37, 1941.
3. BARKER, NELSON W. and COUNSELLER, VIRGIL S. Prevention and treatment of postoperative thrombophlebitis. Read at the annual meeting of the American Association of Obstetrics, Gynecology and Abdominal Surgery, 1938.
4. BANCROFT, FREDERIC W. Proximal ligation and thrombectomy for phlebothrombosis of the femoral and iliac vein. *Ann. Surg.*, 121: 175, 1945.
5. CULP, ORMOND S. Postoperative venous thrombosis and pulmonary embolism. *Bull. Johns Hopkins Hosp.*, 62: 1–24, 1940.
6. DE TAKATS, GEZA and FOWLER, EDSON FAIRBROTHER. The problems of thromboembolism. *Surgery*, 17: 153–164, 1945.
7. DE TAKATS, GEZA and JESSER, JOSEPH H. Pulmonary embolism. *J. A. M. A.*, 114: 1415–1421, 1940.
8. FINE, JACOB and STARR, ARNOLD. The Surgical Therapy of thrombosis of the deep veins of the lower extremities. *Surgery*, 17: 232–239, 1945.
9. HOMANS, JOHN. Thrombosis as a complication of venography. *J. A. M. A.*, 119: 136, 1942.
10. HOMANS, JOHN. Deep quiet venous thrombosis in the lower limbs. *Surg., Gynec. & Obst.*, 79: 70–82, 1944.
11. JENSEN, D. RUS. The problems of thrombophlebitis. *Ann. Surg.*, March, 1945.
12. LOWENBERG, EUGENE L. Femoral vein ligation in the treatment of pulmonary embolism due to femoral thrombophlebitis. *Virginia M. Monthly*, 71: 288–295, 1944.
13. MCCARTNEY, J. S. Postoperative pulmonary embolism. *Surgery*, 17: 191–206, 1945.
14. OCHSNER, ALTON. Intravenous clotting. *Surgery*, 17: 240–259, 1945.
15. SHACKELFORD, R. R. and WHITEHILL, R. Successful ligation of the left common iliac vein for thrombophlebitis complicated by pulmonary emboli. *Bull. Johns Hopkins Hosp.*, 73: 307, 1943.
16. VEAL, JAMES ROSS and HUSSEY, HUGH HUDSON. Surgery of deep venous thrombosis of the lower extremities. *Surgery*, 17: 218–230. 1945.
17. WELCH, CLAUDE E. and FAXON, HENRY H. Thrombophlebitis and pulmonary embolism. *J. A. M. A.*, 117: 1502–1508, 1941.

SIMPLIFICATION OF SPLIT SKIN GRAFTING

GUM ACACIA TECHNIC

CAPTAIN LEONARD R. RUBIN*
MEDICAL CORPS, ARMY OF THE UNITED STATES

THIS is a report of a method first described on February 2, 1944, at a medical meeting in the North African Theater of Operations, and since modified into its present form. The work was undertaken as a means of avoiding two serious disadvantages of the usual pressure method of skin grafting: (1) *Laborious* and *time-consuming suturing* and (2) marked postoperative discomfort resulting from pressure dressings.

The Padgett dermatome has simplified the cutting of a split skin graft. Our method carries simplification forward to the application of the donor skin to the recipient site. We had read of 50 per cent gum acacia as a "glue" for nerve grafts by Klemne, Woolsey and deRezende.[1] Stimulated by Sano's[2] report of successful skin grafting without sutures and pressure dressings, and made aware of the non-irritating cohesive action of 50 per cent gum acacia, we were naturally led to the method finally evolved at this hospital.

Thus far we have had the opportunity of applying the gum acacia method with increasing simplification to 210 grafts for skin defects caused by burns and trauma. These were located in various anatomical locations.

TECHNIC

Preparation of Gum Acacia "Glue." Powdered gum acacia, U.S.P., is gradually added to boiling hot water until a 50 per cent colloidal solution is formed. The mucilagenous solution is autoclaved for fifteen minutes under fifteen pounds pressure.

Recipient Site. The grafts have taken on fascia, fat, muscle, granulation and scar tissue. The edges of a granulating wound are usually excised to give a primary union border. Granulations may or may not be trimmed, depending upon the condition of the wound. Necrotic bases may be trimmed down to fat, fascia or muscle. Bleeding must be controlled for the graft to take. The skin area around the wound is painted with tincture merthiolate. The wound proper is never washed with any solutions.

Donor Site. The site is prepared by successive washes with green soap, saline and alcohol. No strong antiseptics are used. The skin is cut with the aid of the Padgett dermatome, to a thickness varying from .014 inch to .024 inch. The thicker grafts are chosen for surfaces of joints or parts which are weight-bearing or exposed to trauma. The usual donor sites have been the anterior and posterior thigh, abdomen and loin.

A pattern of the recipient site is fashioned out of muslin and outlined on the donor site with an applicator dipped in merthiolate. The outlined area of skin is washed with ether and painted with rubber cement in preparation for the cutting by the dermatome.

The donor site, after the skin graft is cut, is disposed of by a simple dressing of fine mesh gauze (usually 4 inch bandage). It is not uncovered for fifteen days. At this time it is usually found to be healed.

Application of Graft. The removed donor skin is not, at any time, washed or moistened. The graft is placed, raw surface down, on a flat metal sheet. Sulfanilamide powder is dusted on. The cement is wiped away with a dry sponge; the sulfanilamide powder acts as a mild abrasive. This facilitates the removal of the rubber

*Chief of Section, Plastic and Maxillofacial Surgery, 37th General Hospital, U.S.

Fig. 1.

Fig. 2.

Fig. 3.

Figs. 1, 2 and 3. Third degree burn of hand caused by fire in a tank destroyer struck by a shell. The initial treatment consisted of superficial débridement followed by vaseline gauze pressure dressing to hands. The patient was admitted to the General Hospital fifteen days after his burn. He showed third degree sloughing burns of both hands and wrists, the dorsum of his hands, and both surfaces of his wrists being involved. He was started on penicillin therapy, 25,000 units every three hours, and multiple transfusions given to restore his lowered proteins and hemoglobin to near normalcy. Twenty-three days after the burn, the hands were completely débrided, all sloughing tissue being removed surgically under general anesthesia. All dorsal tendons were either exposed or partially burned. All dorsal phalangeal joint capsules were destroyed with joints opened. The hands were put into a pressure dressing and six days after débridement, or twenty-nine days after the original burn, the patient was grafted. The split skin grafts were .022 of an inch thick and were applied with the gum acacia technic, skin clips being used to approximate the skin edges. No pressure was used, the only covering on the grafts being boric acid gauze strips to prevent drying. The hands were placed in cradles. Figure 1 shows granulating hand just prior to skin grafting. Figure 2 shows hand forty-eight hours postoperatively, clips still in and now ready to be removed. Figure 3 shows graft twenty days postoperatively. Three dermatome drumfuls had been used for this hand. Physiotherapy in form of passive motion and encouragement of active motion was started on the seventh postoperative day.

cement which remains after the separation of the skin from the drum of the dermatome.

FIG. 4. (See legend p. 305.)

Fifty per cent gum acacia is painted very thinly on the raw surface of the graft with a camel's hair brush. The layer of gum acacia is so fine that a tongue depressor scraped over the painted surface is unable to demonstrate an excess of gum acacia at the edges of the graft.

The recipient site is dried repeatedly until all oozing has ceased. The donor skin is stretched during application to the recipient site so as to reach an accurate edge-to-edge approximation. This is maintained by the use of Michel skin clips, lightly pressed. Where Michel clips are not available, they can be made by cutting diamond shaped forms out of a tin can, such as the very pliable metal container of a bottle of dried plasma. These are removed in forty-eight hours. If the graft cut is less then .010 of an inch thick, it is unnecessary to use clips, provided the graft is of the same size as the defect. We can do this because the contractability of skin .010 of an inch or less is easily overcome by the adhesiveness of the gum acacia as adhesion begins. Where oozing may be expected, as from freshly trimmed granulation tissue, wound edges or muscle beds, we employ tiny stab holes about 4 mm. long, to allow drainage. The number and position depend on the expected degree of oozing and on the irregularity of the surface. The graft is "ironed out" with a gauze sponge to evacuate all of the blood accumulated while applying the graft. With only gentle pressure applied to the graft through dry gauze, the graft adheres to its bed over the entire area. A dressing consisting of a plain gauze pad of about four thicknesses is cut and fitted to the grafted area. Several layers of gauze are then placed over the entire area and bandages wrapped about as for any wound. Adhesive may be used as well. In all cases of grafting about the face and hands, we use no dressing at all except one layer of boric acid gauze. To protect the graft from early trauma which might dislodge it, we apply a cage fashioned from a wire ladder splint, the type commonly used in orthopedics.

Postoperative Course. The graft is uncovered for the removal of skin clips at the end of forty-eight hours and wet dressings of saturated boric acid solution are applied and then continued for several days. At the end of forty to forty-eight hours the graft is purplish and mottled. Mottling is more extensive in the part of the graft overlying a muscle base or any area where capillary oozing may occur in the brief period before the graft has become fixed. The color of the graft lying on granulation tissue often is a normal pink. Mottling and purplish discoloration begins to fade on the fourth day and has usually disappeared by the fourteenth day.

OBSERVATIONS

We have used the gum acacia method for 210 consecutive grafts during the past eleven months; fifty-four times on third degree burns and 156 times on skin defects caused by war traumas. We have had only eight failures on the grafts for burns and

ten failures of grafts for traumatic cases in spite of the fact that all wounds are grossly contaminated and many are obviously infected at the time of skin grafting.

Fig. 5.

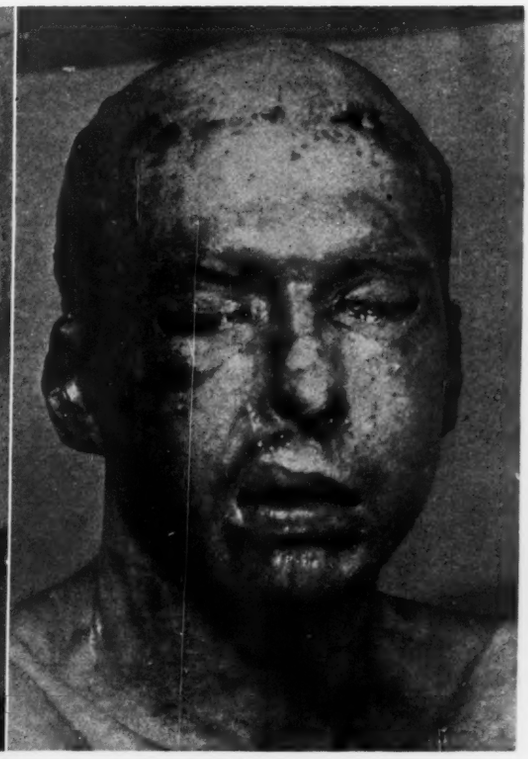


Fig. 6.

Figs. 4, 5 and 6. Third degree burns of face. These three photographs are of the same patient as described in Figures 1 to 3. On admission fifteen days after his burn, he had sloughing granulating third degree burns of forehead, cheek, scalp, eyelids and nose. Several days of wet boric acid dressings removed slough, leaving clean granulations. Twenty-three days after his burn, at the time of the hand débridement, bilateral tarsorrhaphy was done. (Fig. 4.) Some segments of skin were present on both upper eyelids. Granulations on lower eyelids came to the edge of lids. Sixteen days later, a complete dermatome split skin graft, .020 of an inch was applied to forehead, using gum acacia as a "glue" and using several clips to hold position. Clips were removed in twenty-four hours. This is demonstrated in Figure 5 just prior to removal of skin clips. Five days later, or twenty-one days after the tarsorrhaphy, a drumfull of split skin, .010 of an inch, was laid over both eyelids and cheek in one sheet, slits having been made for lid margins. Gum acacia 50 per cent was used as the adherent; a few clips about the lateral margins of the wound were used for skin approximation. Several tiny stab holes were made along Langer's lines. Boric acid gauze strips were placed over the grafts for protection. No other covering was used. Clips were removed in twenty-four hours. Figure 6 shows patient twenty days after the last graft. Further excision and release of contractures about nose and mouth are planned for later date. Skin texture of forehead flap is excellent. It is soft, freely movable and has retained a normal color, blending in with patient's facial coloring. The skin over the eyelids is a shade or two darker than the forehead. The skin for both areas had been taken from the inner thighs. Some contractures have developed at the medial canthi; these will have to be corrected later.

Our failures occurred in those cases in which the infection advanced into frank pus formation in spite of the routine preoperative and postoperative administration of sulfadiazine or penicillin.

These failures showed marked overgrowth of bacteria not susceptible to sulfadiazine or penicillin, such as pyocyaneus, Staphylococcus aureus, and non-hemolytic streptococcus.

Fifty per cent gum acacia is an excellent glue for the adhesion of a split skin graft to the recipient site. This is in part due to its high osmotic pressure which tends to absorb fluid in the vital zone of connection between graft and base. This serves a

double purpose. First, it ensures a nourished medium of body fluid bathing the graft until capillaries have grown into it.

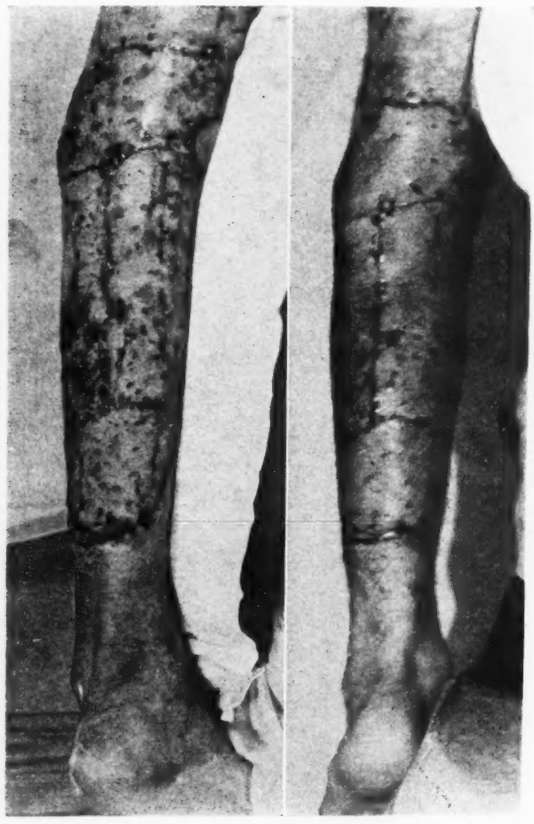


Fig. 7. Fig. 8.

Figs. 7 and 8. Third degree burns of thigh and leg. These photographs illustrate a third degree burn of posterior aspect of thigh and leg. The patient was admitted to the General Hospital thirty-nine days after burn, with infected necrotic slough present on infected granulations. A débridement was carried out five days later after nutrition and blood chemistry were restored to normalcy by multiple transfusions. The patient was started on 25,000 units of penicillin every three hours. Five days after the débridement three dermatome drumfuls of split skin graft .020 of an inch thick were applied to granulating surface, 50 per cent gum acacia being used as a "glue," skin clips being used for skin approximation. Boric acid gauze strip was the only covering. A protective cage was laid over the graft to protect it from trauma. Figure 7 shows the graft at the end of the third day, the clips having been removed. The graft is still mottled. Figure 8 shows the graft twenty days later. The patient is walking at this time.

Second, the fixation of plasma at the junction of the graft and wound allows the formation of dense fibrin which binds the graft securely.

The acacia is no barrier against the ingrowth of blood vessels. This is apparent from our clinical results as well as the studies of deRezende[1] in nerve grafts. The original dead white color of the graft changes to a purplish hue in most cases, usually within thirty-six hours. In the instances in which the grafts did not go through the purple phase, they simply changed from dead-white to pink. It is our opinion that the purple coloration may, in part, be due to the appearance of changed blood, absorbed by the gum acacia, and visible through the split skin graft.

The adherence of skin edges without the use of skin clips or sutures can be obtained by simply allowing the donor skin to be overlarge so as to allow for a contraction of the graft without tension on the edges. We prefer, however, to use an exact size graft and secure edge-to-edge approximation with the aid of skin clips. We believe that contraction of the graft delays easy penetration of blood capillaries. Furthermore, in many instances in which we have required extensive areas of skin, we have been obliged to be sparing. An exact size graft is economical compared with an overlarge graft.

Clips serve still another purpose. Since all grafts contract secondarily it has long been advised to undermine skin edges adjacent to the wound defect and when grafts are laid down to tuck the edges under in such manner as to make a redundant cuff, allowing for the contracture. The application of skin clips automatically produces this "cuff-like" arrangement desired.

Acacia as a gluing agent for skin grafting has not produced any untoward side effects sometimes associated with acacia infusions as a blood protein substitute. The quantity used in our largest graft was less than ½ cc.; in the average case it rarely exceeded ¼ cc.

CONCLUSIONS

Split skin grafting with the aid of 50 per cent gum acacia "glue" has been

described as the simplest of the three methods we have employed: the standard "pressure-suture" technic, the "Sano coagulum" method and the "gum acacia clip" method. Of the elements and advantages of our present technique, we are stressing the following facts:

TABLE I
ANATOMICAL DISTRIBUTION OF GRAFTS

	No. Cases
Scalp	1
Ears	2
Face	5
Neck	3
Axilla	2
Arm	7
Forearm	10
Antecubital space	7
Hand	36
Wrist	4
Chest	4
Hip	2
Back	2
Abdomen	2
Buttock	2
Thigh	43
Popliteal	18
Knee	4
Leg	41
Ankle	2
Foot	11
Stump, arm	1
Stump, forearm	1

1. The successful take of 92 per cent of the grafts in 210 operations is a striking record of grafting on unselected war wounds.

2. Fifty per cent gum acacia is available everywhere and is simple to prepare and sterilize.

3. The adhesiveness of the gum acacia permits the easy application of grafts to difficult sites, such as joint surfaces, neck, face, and irregular deep wounds.

4. Operating time has been reduced from one-half to one-third of that required by the "suture and pressure" method.

5. The use of skin clips facilitates and insures the accurate apposition of skin edges of the graft, with a minimum waste of donor skin. Removal in forty-eight hours leaves no skin marks.

6. The cosmetic value of the graft is enhanced by the absence of suture necrosis and is not impaired by the tiny stab holes.

7. The absence of a pressure dressing allows the patient to remain comfortable.

REFERENCES

1. Klemme, Woolsey, deRezende. Autopsy nerve grafts in peripheral nerve surgery. *J. A. M. A.*, 123: 393–396, 1943.
2. Sano, Machteld E. A coagulum contact method of skin grafting as applied to human grafts. *Surg., Gynec. & Obst.*, 77: 510–513, 1943.

CONTROL OF THE THYROID STORM*

CAPTAIN IRWIN SCHIMMEL
MEDICAL CORPS, ARMY OF THE UNITED STATES

ALTHOUGH the normal activity of the thyroid gland, one of the key members of the endocrine system, is probably better understood than many of its associates, much of its pathophysiology remains unknown and will have to be fathomed by future investigators. Overactivity of the thyroid, commonly called hyperthyroidism, is not clearly understood at all. At present, we realize that by surgical removal of all or most of an overactive thyroid gland we can control its hyperfunction, but we do not completely understand the mechanism behind this abnormal state of body physiology. If we did, hyperthyroidism would probably be classified among the medical and not the surgical diseases. Our dilemma regarding the pathophysiology of an overactive thyroid is multiplied a thousand-fold when we try to understand the curious state referred to as crisis. It is one of the gravest and most disconcerting complications encountered in the management of patients with hyperthyroidism. This is a condition concerning which comparatively little has appeared in the literature. When once fully developed, it is most difficult to control, in spite of the most energetic treatment and it results in a considerable number of fatalities.

In this discussion, we shall attempt to present the problem of thyroid crisis from the standpoint of control of the postoperative thyroid storm, or surgical crisis. Especially are we interested in postthyroidectomy crisis. Medical crisis, or rampant hyperthyroidism which is the result of medical neglect and not the result of thyroidectomy, will not be considered at any length.

In reviewing the literature on postthyroidectomy crisis, one is impressed by the difficulty in establishing its incidence since it is not always distinguished from the so-called severe postoperative reaction. Unless the patient dies in the profound toxemia and violent and overwhelming disturbance of his metabolic processes, the surgeon often fails to classify his case as one of crisis. Hence, a recovered case is usually called one with a severe reaction to operation. Undoubtedly, many cases of crisis are never so classified in the hospital records, to say nothing of the literature.

PHYSIOLOGY

The general physiology of the normal thyroid gland is well known to all of us. Much credit for our present knowledge must go to David Marine[32] for his early work along these lines. He states that the principal function of the thyroid is to increase the oxidative processes of the body. He demonstrated many of the interrelationships between the thyroid and its associate endocrine glands such as the pituitary, thymus, pancreas and adrenals. He laid down three general principles, namely, (1) the thyroid belongs ancestrally to the alimentary tract; (2) it is an organ endowed with tremendous capacities for increasing and decreasing its functional activity, as indicated by changes in weight, microscopic appearance, iodine content and blood supply; (3) hyperplasia is an index of hyperactivity but not necessarily hyperfunction. Myxedema and cretinoid states may occur in individuals and animals with typical hyperplasia.

We are all well acquainted with the rôle iodine plays as the essential element of the thyroid gland and how its administration exerts a profound effect upon the thyroid tissue. The quantity of iodine in

* From the Guthrie Clinic and Robert Packer Hospital, Sayre, Pennsylvania.

the normal thyroid gland is between 2 and 3 mg. per Gm. of dried tissue.[3] The average total storage in the thyroid is almost 10 to 15 mg. A content below 1 mg. per Gm. of dry gland (0.5 mg. per Gm. of fresh tissue) is supposed to indicate thyroid abnormality, and in severe paranchymatous goiter, either simple or exophthalmic, it may be as low as 0.25 mg. or less per Gm. In colloid goiters, the general level is higher. The thyroid gland, though constituting only 0.05 per cent or less of the body weight, contains about 20 per cent of the body's entire supply of iodine. Blood normally contains from 10 to 12 micrograms per cent of iodine. In hyperthyroidism it is nearer 30 micrograms per cent and in hypothroidism between 7 to 10 micrograms. In health from 25 to 75 micrograms of iodine are excreted daily in the urine.

A glycerine extract of sheep's thyroids was first employed successfully for the relief of myxedema in 1891. The thyroid tissue itself when given by mouth was shown to be physiologically active. Bowmann, in 1895, discovered that iodine was an important constituent of the thyroid extract. By means of acid hydrolysis of thyroid tissue he obtained a brownish powder containing 9.3 per cent iodine and possessing the physiological activity of the whole gland. He believed that the iodine was present in organic combination and thus called the compound iodothyrin. However, it was later demonstrated that the active constituent was attached to a protein, thyroglobulin, which is the chief component of the colloid material filling the alveoli of the gland. In 1916, Kendall isolated the active principle of the thyroid in crystalline form and he called this thyroxine. In 1927, Harrington and Barger synthesized l-tyrosine and showed that it had the same pharmacologic properties as natural thyroxine.

The fundamental mechanism of action of the thyroid hormone is not known.[12] The site of action cannot be stated with any degree of certainty. Some men believe that the hormone acts peripherally on the individual cells, the action being similar to that of a catalyst. Yet, if thyroxine be added to tissue slices, there is no increase in oxygen uptake. On the other hand, tissue slices taken from animals that have previously received the hormone show a definitely increased oxygen uptake. Likewise, the oxygen consumption of tissues taken from thyroidectomized animals is low.

Denervated organs *in situ* respond to thyroid as readily as organs having an intact inervation. The totally sympathectomized animal also responds to the hormone with an increased metabolic rate. There is evidence, however, that the spinal animal shows no increase in oxygen consumption after the administration of thyroid. This would indicate a central site of action. Thus, there are those who believe that thyroid acts upon the vegetative centers in the brain stem. The alleged high iodine content of the diencephalon is thought to be significant by those who adopt this point of view. Nevertheless, much work must be done before a complete understanding of thyroid physiology is available.

SYMPTOMATOLOGY

Before we can discuss intelligently the syndrome known as postoperative thyroid crisis, we must attempt to describe, in some fashion, the clinical picture. McQuillan[34] distinguishes two types of postoperative toxemia. The acute form occurs suddenly and without warning, even during the operation, and more commonly within the twenty-four to forty-eight hour period postoperatively. This is characterized by a rapid and increasing pulse rate with diminished volume and by a moderate or marked rise in temperature. In addition, there is often extreme chorea-like mental and physical restlessness, marked pallor, a dry tongue, vomiting and sometimes diarrhea. There is often a peculiar dyspnea in which the breathing is slow and sighing, and there is the complaint of pressure on the chest and the inability to take a deep

and satisfactory breath. The urine may show the presence of acetone. On the whole, the picture may resemble acute hyperinsulinism. Death may occur suddenly at any time during the progress of this group of symptoms. Lahey[26] believes that the earliest signs of thyroid crisis are a rising pulse rate, increased excitability, lessened emotional control and overactivation.

Less frequently, one sees the subacute variety of toxemia in which the pulse rate and temperature rise more slowly and gradually with fluctuation periods over a week or ten days. There may be occasional periods of restlessness, but this is overshadowed by stupor. Nausea and vomiting may be common and pharyngeal paralysis of varying degrees may be seen. This subacute type seems to resemble uremia and is more resistant to treatment. There seems to be no sign or symptom which will warn the attending staff that this toxemia is coming, and it is well known that such a condition may follow surgery in the patient whose preoperative thyrotoxicosis is mild as well as one with a severe type.

According to Drismore and Crile,[7] the acute thyroid storm is most commonly seen at its maximum severity on the second night after operation. At this time the temperature and pulse rate are markedly elevated with temperatures of 105 to 106°F. being characteristic. The patient is stimulated, restless and in very severe cases may be in such an active state of delirium that restraint is required.

DIFFERENTIAL DIAGNOSIS

Post-thyroidectomy crisis is rarely difficult to diagnose by an experienced house staff. Once the symptoms are evident with the extreme hyperpyrexia, sweating, flushing and restlessness and progressing toward delirium, mania and coma, there is little in differential diagnosis that is important. Hemorrhage will give a low temperature with extreme respiratory difficulty, crowing and an inspiratory tug. With atelectasis, there is more respiratory distress initially and the physical signs in the chest are usually sufficient to establish the diagnosis. If this fails, the roentgenogram of the chest will confirm the diagnosis. Vascular accidents will usually produce localizing signs to indicate their presence, and will be accompanied by a lower temperature.

According to Fiske,[8] much difficulty may arise in diagnosing thyroid crisis as a postoperative complication of surgery elsewhere in the body. Here such things as internal bleeding and liver shock must be considered. However, there is good evidence to show that there is a very close relationship between liver disorders and thyroid crisis.

INCIDENCE

Before the days of adequate preoperative preparation of the patient with iodine, postoperative thyroid crisis was not infrequent. Greene[15] states that the majority of cases of crisis occur in patients in whom the hyperthyroidism has been present for a long time. Either these patients have not sought relief from their hyperthyroidism or they have had only half-hearted treatment from their attending physicians.

Nevertheless, in spite of refinements in technic in handling thyroid patients, acute postoperative crisis still accounts for many goiter deaths. Lahey[24] reports that his clinic had done 15,200 thyroid operations upon 13,000 patients. The mortality rate, counting all such patients who died from any cause whatever while in the hospital was 0.85 per cent. This represents a total of 111 deaths in 13,000 patients. Of this number, 40 per cent died in thyroid crisis, 10 per cent were thyrocardiacs who died in cardiac failure and 10 per cent died of emboli. The remainder died of other causes. He makes no mention of the incidence of crisis in patients who recovered, merely describing those who died. In addition, he notes that of fifty-three persons dying while awaiting operation, 33 per cent died of crisis.

Maddock, Pedersen and Coller[30] reviewed the cases at the University Hos-

pital in Ann Arbor, Michigan, and found that there were 123 deaths from goiter from 1925 to 1933 and that eighty-eight were due to thyroid crisis. Thirty-seven occurred postoperatively following thyroidectomy. Bayley[2] analyzed the deaths of the fifty-one patients who died of preoperative crisis and found that there were approximately twice as many females as there were males. In addition, he found that the average age in each sex group was 50 years.

In a recent paper, Crile[6] reports a series of 800 thyroidectomies in which there was no typical thyroid crisis with uncontrolled hyperthermia and soaring pulse. However, he believes that the postoperative thyroid reaction is still directly or indirectly responsible for the majority of serious postoperative complications. It paves the way for cardiac decompensation, hepatic failure and metabolic exhaustion. Interestingly enough, he reports that fatal crisis occurs 2.4 times as frequently during the hot summer months as during the rest of the year.

McGregor[33] in an attempt to study the geographical incidence of severe hyperthyroidism and preoperative crisis sent out a questionnaire to all of the leading goiter clinics in the United States and Canada. He found very little crisis in the East, most of the cases occurring in New Orleans, Michigan and Southern Ontario.

ETIOLOGY

Probably one of the least understood phases of thyroid disease is the mechanism of production of thyroid crisis. It is obviously a condition of profound toxemia and a violent and overwhelming disturbance of the metabolic processes of the body. Undoubtedly, there is a marked alteration of blood chemistry. Maddock et al.[30] have very aptly described our dilemma: "Metabolic processes appear to be so tremendously disturbed that some alteration in body chemistry producing the effect ought to be discoverable and ought to be measurable if only one knew what to measure."

In a rather exhaustive series of blood studies on patients with hyperthyroidism, both preoperatively and postoperatively, Maddock studied the chief electrolytes of the blood such as sodium, potassium and phosphates. Nothing definite was found and he said, "Our search for abnormalities of inorganic iron concentrations in the blood of patients with hyperthyroidism has not been fruitful." Then they studied hepatic function in hyperthyroidism and found that their data on preoperative hepatic function gave no indication as to the mildness or severity of the postoperative course. Postoperatively, they did find an increase in the incidence and degree of impaired hepatic function and an increase in hyperthyroid reactions, but there was no evidence to show that one was the cause of the other. They admitted that a third factor could be responsible for both.

Finally, they attempted to study the relationship between the adrenals and thyroid crisis. To do this, they used the Whitehorn method for estimating the amount of epinephrine in the venous blood. The test was performed on sixteen patients with hyperthyroidism, both before and after the operation. The result was negative in five and positive in eleven. In four of the eleven, crisis developed; two died preoperatively and one postoperatively. However, they concluded that, so far, no positive identification of increased amounts of a substance which yields biologic reactions similar to those of epinephrine could be made in the blood of patients with hyperthyroidism.

In substantiating the effect of epinephrine as a factor in producing severe post-thyroidectomy reactions, Goetsch and Ritzmann[10] showed that the operative reactions observed in the patient with hyperthyroidism have been approximately duplicated in character and degree by a small dose of epinephrine hydrochloride administered subcutaneously to the same patient several days prior to operation. These include restlessness, hyperthermia, tachycardia and the other general characteristics of thyroid crisis. Hence, they

believe that postoperative reactions are due to increased amounts of epinephrine liberated from the adrenal glands because of the various factors which comprise the operation.

The thymus gland, because of its proximity to the thyroid gland, has attracted the attention of many workers. Many people have attempted to ascribe the death of crisis to the thymus gland. Even though the majority of patients who die of crisis have been found to have a persistent and hypertrophied thymus gland, the clinical picture of crisis does not resemble the usual thymic deaths, if such an entity really exists. Margolis[31] observed hyperplasia of the thymus gland in 85 per cent of the patients with exophthalmic goiter. However, he believed that the presence of a hyperplastic thymus probably represents an inherent constitutional predisposition to the development of hyperthyroidism. Thus, the relationship between a hyperplastic thymus and thyroid crisis is, at present, vague and inconclusive.

Crile[5] attempted to study liver failure as a factor in producing postoperative delirium in patients with hyperthyroidism. He reports an incidence of 6.5 per cent of some degree of mental confusion or delirium in 200 consecutive thyroidectomies. By doing liver function tests on these patients he found that impaired liver function was the most common single cause of postoperative confusion and delirium. However, the liver failure usually occurred on the second or third postoperative day when the postoperative thyroid reaction was subsiding. In addition, he believed that this complication of hyperthyroidism was most commonly seen in elderly patients and was more closely correlated to the age of the patient than with the height of the basal metabolic rate.

Ransom and Bayley[36] report the necropsy findings on fourteen of thirty-seven patients who died of crisis. In each instance the findings were of little assistance in clarifying the cause of mechanism or death. They report that the significant findings were usually cardiac dilatation, arteriosclerosis in the older patients, frequently a persistent thymus, and occasionally an early bronchopneumonia, the latter process being altogether too early for the severe and rapidly fatal reactions. The majority of their patients dying of postoperative crisis were those who had hyperthyroidism of long standing with marked weight loss, emaciation, or those who were iodine resistant. Delay in surgical intervention as well as iodine drugging were among the most important factors in accounting for the unexpected postoperative disasters. They concluded that the necropsy findings assisted very little in understanding the exact nature of postoperative thyroid crisis. In addition, they believe that too much surgery was often the cause of severe postoperative reactions and they believe that more staged operations would reduce the mortality due to crisis. However, Foss[9] reports several deaths following pole ligations and even after single ligations. He agrees that the patient's condition on the operating table is rarely an index of what the postoperative period will reveal.

Kroger and Toland[23] report a series of twenty-seven deaths in 2,070 cases. All but two of their cases were one-staged procedures and eleven of their patients died in crisis. These men, in analyzing their deaths, believed that many of their patients could have been saved by staged operations. They also believed that the pulse rate was probably the best index of toxicity but that no code of rules could be laid down which would indicate the exact toxic state.

Foss[9] reports necropsy findings on twenty-nine patients who died from thyroid disease, twenty of whom died in crisis. They investigated the pathologic states of the heart, liver and thymus very carefully. There was insufficient proof to attribute the cause of death primarily to any one of these organs. They believe that the pathologist has little more to offer in deciphering the mystery of thyroid crisis

and that it remains for the physiologist and experimental pathologist to discover the true nature of the toxemia which is responsible for the death due to thyroid crisis.

There are many authorities who believe that crisis is due to a release of too much thyroid hormone or due to an exacerbation of the pre-existing thyrotoxicosis occurring postoperatively. However, McQuillan[34] says that it is difficult to understand how this toxemia can be due to too much normal thyroid secretion or even due to too much abnormal secretion when it occurs most often following a subtotal thyroidectomy. The remaining thyroid tissue is usually small in amount and its function is markedly impaired, at least, temporarily. Upon postmortem examination of the thyroid tissue of such patients the alveoli show little colloid and much evidence of disintegration and destruction. All this, he believes, seems to point to the fact that the patient dies from a sudden and complete absence of the thyroid hormone, rather than from too much of it. In fact, he reports encouraging results from the subcutaneous administration of a liquid thyroid preparation in the treatment of this condition. This preparation seems to reduce the pulse rate and temperature along with an amelioration of the restlessness, delirium, nausea and vomiting.

ANALYSIS OF CASES

Since October, 1929, there have been 1,570 patients who had thyroidectomies at the Guthrie Clinic with three deaths due to crisis postoperatively. In all, there were twelve deaths, nine being due to other causes. All of these cases were done in one stage except twenty-three in which staged procedures were employed. A subtotal thyroidectomy, performed by the primary superior polar attack, was used throughout. Thus the incidence of crisis postoperatively is 0.19 per cent. We have seen no case of post-thyroidectomy crisis since 1934.

The average age of the patients who developed crisis was forty-seven and all were of the female sex. All of the crisis cases were diagnosed as toxic goiters preoperatively, two being of the nodular variety. All had had goiters for many years, the average length of time being twenty-five years prior to operation. One patient had had a polar ligation sixteen years prior to thyroidectomy.

Preoperatively, all of the patients were prepared in the usual manner with Lugol's solution and adequate preparation was employed. The average preoperative hospital stay was sixteen and one-third days, the minimum fourteen days. All of the patients had elevated metabolism readings, the average being 47 per cent. However, all had shown a definite improvement in the basal metabolic rate prior to surgery. The average blood pressure was 156/83 and the average pulse rate was 87 preoperatively.

Laboratory studies in all of the patients included the usual blood chemistry and urinalysis. Only one patient showed any significant urinary findings in that she had some pus in her urine. Another patient had latent syphilis, her blood Kahn recording being 3+ and her Wassermann 4+. The average blood sugar was 135 and the blood urea nitrogen was 30.

Crisis developed on the day of operation in one patient, the day following operation in another patient and two days after operation in the third patient. Each death was the usual picture of crisis except one in whom the postoperative temperature remained around 101°F. However, her pulse rate was in the neighborhood of 160 or more. The other two patients had temperatures ranging between 104° to 106°F. and pulse rates between 145 to 180 per minute.

A postmortem examination was permitted in only one case and this patient also had a dilatation and curettage of the uterus at the time of thyroidectomy. Both at operation and at postmortem examination there was considerable pus in the lumen of the uterus, a fairly large abscess of the uterine wall being demonstrated at

autopsy. This was the woman who did not show the severe febrile response of crisis prior to her demise.

The patient who died the day of operation was one who bled rather profusely after operation and had to be returned to the operating room for further control of hemorrhage. Needless to say, hemorrhage was probably the factor which incited the severe postoperative thyroid reaction and was responsible for the crisis.

PROPHYLAXIS

A thyroid crisis is difficult to treat once it is established but it is relatively easy to prevent. Thus, we believe[20] at the Guthrie Clinic that it is more than mere coincidence or good fortune that we see so few post-thyroidectomy storms. It is our belief that the prevention of postoperative reactions begins with our first contact with the patient. These patients are nervous, suspicious and emotionally upset when first seen in the hospital or clinic. Considerable skill in meeting the patient and allaying his fears is required by the men who are in charge of the early treatment of these patients. Both the internist and surgeon should meet the thyroid patient and discuss the plan of treatment jointly soon after the diagnosis is established.

Guthrie and Woodhouse[18] have outlined the preoperative care of the goiter patient as practiced at the Guthrie Clinic. They state that the goiter patient needs reassurance and encouragement regarding his condition and the final outcome in his case. He should be informed as to what lies ahead of him in respect to study, preoperative therapy, and the operation. Great care is given toward treating the goiter patients individually giving vent to his eccentricities. The medical and nursing staff of the hospital realize that these patients are irritable and easily annoyed. Hence, these patients are "spoiled" in our effort to satisfy them in every way.

The period of preparation of the patient is long enough to get the patient in proper condition so that his operation may be a safe one. Much care is used in catering to the whims of the thyroid patient. Although the average case required about ten to fourteen days of preparation, as long as six or eight weeks may be taken in severe cases if the staff believes that prolonged preparation is necessary. We never hurry our patients to the operating floor, preferring to be ultra-conservative rather than hasty in our preoperative therapy. According to Guthrie and Conklin,[17] rest is essential for thyrotoxic patients, and it should be both physical and mental. It is not necessary to keep these patients in bed all of the time unless they are extremely weak or in cardiac failure. They are allowed limited activity but we try to have them nap in the afternoon and sleep well at night. Sedatives are given if necessary. Iodine is administered in the form of Lugol's solution and a full, high caloric diet is prescribed. Routinely, the larynx is examined by the laryngologist to see if there is an impairment of function of the cords preoperatively. This procedure is especially of value in cases of secondary operations.

Much skill is required in determining the proper time for operation and at the clinic we rely solely upon the judgment of our internist who is a master in handling thyroid patients. He is guided by four factors: (1) The improvement of the nervous stability of the patient; (2) the improvement in and maintenance of a reduced pulse rate. This is probably the best guide he has of estimating clinical improvement of the patient; (3) a reduction in the basal metabolic rate; and (4) a definite gain in weight. This is not always present but it is reassuring when it occurs.

Once the date for operation has been selected, the patient receives a hypodermic every morning containing sterile water or morphine sulfate, gr. $\frac{1}{8}$ (.008 Gm.).[38] This begins our modified anoci-association technic. A day or two prior to the operation the patient is taken to the basal metabolism room for a reading. The morning of operation the breakfast is delayed as for another

metabolism test but sodium amytal, gr. 6 (.396 Gm.) is given about one or two hours prior to the operative time. The patient goes to sleep and then receives a hypodermic of morphine sulfate, gr. 1/6 (.011 Gm.) and atropine sulfate, gr. 1/100 (.00066 Gm.) about thirty minutes before leaving for the operating room. He usually does not awake until after the operation. Since his trip to the operating room is supposed to be for another basal metabolism test, the operating room is darkened when he is wheeled in, so that he usually fails to notice any difference from the preceding day's test.

We believe the anoci-association technic is important because it prevents termination of the operation after one side is done and thereby reduces the number of staged procedures. Every surgeon who is interested in goiter patients knows that the toxic patient's pulse rate will climb to high levels as soon as he learns that he is to be operated upon. This occurs even though he is very gratified to learn that the time for surgery has arrived. With anoci-association the patient often does not know that he has been operated upon and all of his excitement over the operation has been prevented.

The operation itself is performed in such a way as to minimize trauma and thereby to prevent postoperative reactions. In the first place, a trained goiter team which acts as an efficient unit is present. The same surgeon and same assistant handle practically all of the cases. Their moves become synchronized so that lost motion and delay are at a minimum. Even the same suture nurse is used although her assistant and the intern vary from time to time.

Much difference of opinion exists among surgeons regarding the choice of anesthesia in thyroidectomies. Our choice is ethylene. This choice is corroborated by Cole.[4] The quiet regular respirations without the secretion of mucus most nearly approximates normal sleep.[20] Any abnormal traction on the recurrent nerves or on the trachea is immediately signalled by noisy breathing on the part of the patient. We are convinced that local anesthesia has little place in thyroid surgery[18] with its sensation of impending suffocation for the patient during manipulation and pull on the gland. The patient's terror under local is graphically evidenced by a mounting pulse rate and a state approaching crisis when traction is applied on the gland. Lahey[25] prefers cyclopropane but our results are better with ethylene.

Unlike many clinics[27] where the decision regarding the problem of a staged operation is decided long before the day of operation, and often during the first meeting between surgeon and patient, we believe that this decision should remain until the time of operation. As a result we have had a paucity of staged procedures at the Clinic, only twenty-three in 1,570 cases, or 1.5 per cent.

We believe that much of our success in preventing postoperative reactions arises in our technic of thyroidectomy. We use the primary superior polar attack, clamping the vessels individually after they divide. We do not throw any aneurysm needles around the pole nor do we have any mass ligatures which can slip when the patient coughs.[19] Each vessel is visualized, clamped, and then cut. We do not attempt to expose the recurrent nerves as Lahey[29] does but our nerve injuries have been few. Our cases of postoperative tetany have been nil.

One of the worst complications following thyroidectomy is postoperative hemorrhage, especially that which occurs when the patient is at the height of his postoperative reaction. If it becomes necessary to take the patient to the operating room or to give him an anesthetic during this stage of his postoperative thyroid reaction in order to control hemorrhage, a severe or fatal crisis may result.[27] In order to prevent oozing from the remnant after the vessels have been ligated with accuracy, we roll the edge of the remnant medially and suture it to the portion which has been

intentionally left attached to the trachea.[21] In this way it is possible to smother bleeding from the raw surfaced remnant. Finally, by the use of fine cotton for sutures and ligatures, it has been possible for us to eliminate the use of drainage tubes in practically all of our thyroidectomies. Even when large substernal and intrathoracic goiters are removed the resulting wounds are closed tightly without drainage. By avoiding drainage tubes it has been possible to reduce our post-thyroidectomy hospitalization from sixteen to nine days.[21]

Postoperatively there is much that can be done to prevent crisis. In the first place, it is advisable that toxic thyroid patients be placed in a private room postoperatively whether they are pay or charity patients.[16] These people require complete rest. This cannot be provided in a noisy ward full of convalescent patients. In addition, it is advisable that these patients be very closely watched by the nursing staff and attending physicians. Any untoward reaction on the part of the patient should be reported immediately to the surgeon in charge and the proper measures should be instituted without delay. The patient is especially watched for difficulty in breathing which may be due to concealed hemorrhage.

It is especially important that the junior house staff be allowed to take the responsibility for opening the wounds of patients who are bleeding. At least half a dozen lives have been saved at the Guthrie Clinic[17] by prompt and deliberate removal of the clips of the wound with removal of the clots in order to prevent suffocation of a patient who was bleeding. Once the wound is opened it is usually possible to take these patients back to the operating room in order to control the hemorrhage with accuracy. Bleeding patients more often die of suffocation than loss of blood.

Whether oxygen in the form of a tent or mask should be used routinely is a matter of individual preference. Crile[6] believes that the patient should be placed in a tent immediately but at the Guthrie Clinic we reserve this for the bad risk patients or those whose operations have been unduly difficult. However, all of our patients are regularly ventilated with a mixture of oxygen and carbon dioxide.

Needless to say, any patient whose metabolic rate is increased needs adequate fluids postoperatively. Many of us, however, forget the rectal method of administering fluid. Routinely, all thyroid patients at the Clinic receive an enteroclysis of about 1,000 cc. of tap water as soon as they return from the operating room. In addition, they are encouraged to drink fluids by mouth if nausea is not marked.

The use of iodine postoperatively is generally employed although its action seems to be unknown. According to Crile[6] the administration of small amounts of iodine should be continued for at least two days postoperatively. However, he does not believe that the postoperative use of large doses of iodine exerts any striking effect upon the thyroid reaction of the patient who has received full doses of iodine preoperatively. Iodine does not act upon the tissues of the body nor upon the thyroid hormone circulating in the blood stream. It acts directly upon the secreting activity of the thyroid gland. Thus, it cannot be expected to produce any further effect upon the postoperative reaction of a fully iodized patient. Its chief benefit lies in its prevention of the symptoms incident to its withdrawal. Nevertheless, we routinely give Lugol's solution to the toxic patient postoperatively. We give m. 30 (2 cc.) in the enteroclysis immediately and then m. 8 (0.5 cc.) three times per day, by mouth, thereafter.[25]

TREATMENT—ACTIVE

Once crisis is established there is a vicious circle of hyperthermia and hypermetabolism. Crile[6] reports that with each degree of elevation of temperature, there is a corresponding increase of 7.2 per cent in the basal metabolic rate. Further, with each increase in the rate of metabolism

there is a proportionate increase in the production of body heat. One of the chief problems in controlling a thyroid crisis is how to break the vicious circle of hyperthermia and hypermetabolism.

Although formerly ice bags were used, and in severe cases the patient was packed in ice, as a result of better postoperative preparation and the use of a cooled oxygen tent that is practically unnecesary now, according to Crile.[6] He believes that ice causes vasoconstriction of the cutaneous vessels and reduces the loss of body heat by radiation. Hence, he believes that it is more physiological to increase the loss of body heat by evaporation. To do this, he increases body perspiration by giving huge amounts of fluid. Since perspiration is directly dependent upon an adequate fluid intake, unless otherwise contraindicated, he recommends 5 to 6,000 cc. of fluid per day, intravenously, if necessary.

Aspirin promotes sweating and it is also a very efficient antipyretic in controlling the hyperthermia of crisis. Crile[6] reports a drop of 1 to 3 degrees F. following the administration of 10 gr. of aspirin to a patient with a temperature of 102° to 103°F. If the patient cannot swallow it by mouth, he suggests that it be given rectally in somewhat larger doses.

Patients with severe hyperthyroidism have exhausted their reserves of glycogen which are normally present in the liver. However, their increased metabolic rates require fuel for oxidation. If nausea and vomiting are present a continuous intravenous drip of 5 per cent glucose is advisable. However, since it is impossible to give more than 2,000 calories per day in the form of glucose without losing much of the glucose through the kidneys, a high caloric, high carbohydrate diet should supplement the intravenous fluid. If the patient refuses food, feedings via a nasal tube may be possible.

Morphine is an extremely valuable drug in controlling the discomfort and restlessness of patients convalescing from thyroidectomy, and especially in crisis. The patient's tolerance to morphine seems to be in direct proportion to the degree of elevation of the basal metabolic rate. Hence, patients in crisis should receive large doses of morphine at frequent intervals unless they are very elderly. Old and debilitated patients tolerate morphine rather poorly and may be excited or severely depressed by rather small amounts of the drug. In addition to morphine, the barbiturates, bromides, or chloral hydrate may be used to quiet the patient.[8]

The effect of iodine in treatment post-thyroidectomy crisis in the adequately prepared patient is equivocal. Most men recommend it because it may help but its direct action is not well understood. Lahey[26] says, "The efficacy of iodine in the treatment of crisis will depend upon whether or not the patient has had iodine previously. If so, as good results cannot be expected as if iodine were being given for the first time." However, Goodrich[11] reports two cases in which there was marked postoperative crisis, one of whom was moribund. Both had failed to respond to the usual postoperative use of Lugol's solution and both improved miraculously after the use of 15 gr. of sodium iodide, given intravenously. This dose was repeated in three to four hours and every twelve hours until the storm was over. Fiske[8] believes that iodine should be given in liberal amounts either in the form of Lugol's or sodium iodide.

It is interesting to note a report by Rhea[37] in which the restlessness of a patient in crisis could not be controlled by any method other than by spinal anesthesia. Although he does not recommend this therapy for routine use, he believes that since the whole treatment of crisis is empirical, spinal anesthesia is justified when the usual methods of controlling restlessness fail.

It is obvious that until we know more about the mechanism of production of thyroid crisis and we have a thorough understanding of the complex relationships between the thyroid gland and the

other endocrines, we must be contented with our present empirical method of treating thyroid crisis.

CONCLUSIONS

1. Thyroid crisis has been one of the chief causes of death following thyroidectomy in all clinics.

2. All surgeons agree that in the light of our present knowledge of the mechanism of crisis, our only hope of controlling the condition is to prevent it. Active therapy once crisis is established, is, at best, symptomatic and empirical.

3. At the Guthrie Clinic we employ every measure known to us in making the post-thyroidectomy reaction as mild as possible. These include long and careful preparation in the hospital with catering to the whims of the goiter patient, anoci-association, a one-staged procedure wherever possible, ethylene anesthesia and minimal trauma at operation via the primary superior polar attack method with no drainage of the wound bed. This is made possible by the use of fine cotton sutures. Postoperatively the patient is very closely watched for hemorrhage and is treated with oxygen, fluids and iodine.

4. The case reports of 1,570 patients who had thyroidectomies with three deaths due to crisis have been reviewed. Only twenty-three staged procedures demonstrates the low incidence of staged operations at the Clinic. In all, there were twelve deaths in our series, nine being due to other causes.

REFERENCES

1. Allen, D. S. Surgical treatment of hyperthyroidism: some complications and problems of frequent occurrence. *Surg. Clin. North America*, 20: 1303, 1940.
2. Bayley, R. H. Thyroid crisis. *Surg., Gynec. & Obst.*, 59: 41, 1934.
3. Best and Taylor. Physiological Basis of Medical Practice. 2nd ed.
4. Cole, W. H. The treatment of thyrotoxicosis. *Illinois M. J.*, 81: 453, 1942.
5. Crile, G., Jr. Liver failure as a factor in postoperative delirium in patients with hyperthyroidism. *Tr. Am. Ass. Study of Goiter*, p. 42, 1940.
6. Crile, G., Jr. Important factors in the surgical management of patients with severe hyperthyroidism. *South. Surg.*, 11: 282, 1942.
7. Dinsmore, R. S. and Crile, G., Jr. The surgical significance and treatment of delirium or confusion following thyroidectomy for hyperthyroidism. *Cleveland Clin. Quart.*, 4: 103, 1937.
8. Fiske, F. A. Thyroid crisis as a postoperative complication. *Tr. Am. Therapeutic Soc.*, p. 133, 1939–1940.
9. Foss, H. L., Hunt, H. F. and McMillan, R. M. The pathogenesis of crisis and death in hyperthyroidism. *J. A. M. A.*, 113: 1090, 1939.
10. Goetsch, E. and Ritzman, A. J. Thyroid disorders. *Arch. Surg.*, 29: 492, 1934.
11. Goodrich, C. H. A note on the intravenous use of an iodide in postoperative thyrotoxicosis. *Am. J. Surg.*, 13: 9, 1931.
12. Goodman and Gilman. The Pharmacological Basis of Therapeutics. p. 1158. New York, 1941. MacMillan.
13. Glenn, F. The pre- and post-operative management of the patient with hyperthyroidism. *Surg. Clin. North America*, 20: 523, 1940.
14. Gray. Anatomy. 24th ed., p. 1289. Philadelphia, 1942. Lea & Febiger.
15. Greene, E. I. and Greene, J. M. Thyroid crisis. *Am. J. Surg.*, 95: 537, 1932.
16. Guthrie, D. Thyroidectomy technique. *Am. J. Surg.*, 6: 631, 1929.
17. Guthrie, D. and Conklin, S. D. The preoperative preparation and the postoperative care of the patient with hyperthyroidism. *Internat. Clin.*, 3: 159, 1934.
18. Guthrie, D. and Woodhouse, K. W. The preoperative preparation of the toxic goiter patient. *Tr. Am. Ass. Study of Goiter*, 1939.
19. Guthrie, D. and Brown, M. J. A technique of thyroidectomy permitting the use of silk, *Surg., Gynec. & Obst.*, 68: 801, 1939.
20. Guthrie, D. Personal communication.
21. Guthrie, D. and Schimmel, I. Drainage in thyroidectomy. *Surgery*, 16: 725, 1944.
22. Hegner, C. F. A history of thyroid surgery. *Ann. Surg.*, 95: 481, 1932.
23. Kroger, W. P. and Toland, C. G. Surgical mortality in thyroid diseases. *West. J. Surg.*, 45: 316, 1927.
24. Lahey, F. H. The management of severe hyperthyroidism. *Surg., Gynec. & Obst.*, 54: 304, 1937.
25. Lahey, F. H. Surgery in hyperthyroidism. *New York State J. Med.*, 39: 108, 1939.
26. Lahey, F. H. The crisis of exophthalmic goiter. *New England J. Med.*, 199: 255, 1928.
27. Lahey, F. H. Aids in avoiding serious complications in thyroidectomy. *Ann. Surg.*, 113: 730, 1941.
28. Lahey, F. H. Acute hyperthyroidism. *New York State J. Med.*, 33: 857, 1933.
29. Lahey, F. H. Exposure of laryngeal nerve in thyroid operations. *Surg., Gynec. & Obst.*, 78: 239, 1944.
30. Maddock, W. G., Pedersen, S. and Coller, F. A. Studies of the blood chemistry in thyroid crisis. *J. A. M. A.*, 109: 2130, 1937.

31. MARGOLIS, H. M. Possible significance of the thymus gland in hyperthyroidism. *Ann. Int. Med.*, 4: 1112, 1931.
32. MARINE, D. The physiology and principal interrelations of the thyroid. *J. A. M. A.*, 104: 2250, 1935.
33. MCGREGOR, J. K. Hyperthyroid crisis. *Tr. Am. Ass. Study of Goiter*, p. 62, 1941.
34. MCQUILLAN, A. S. Treatment of acute postoperative thyroid toxemia. *Ann. Surg.*, 90: 26, 1929.
35. NOEHREN, A. N. and NOEHREN, W. A. The history of the thyroid gland. *Tr. Am. Ass. Study of Goiter*, p. 10, 1936.
36. RANSOM, H. K. and BAYLEY, R. H. Thyroid crisis. *West. J. Surg.*, 42: 464, 1934.
37. RHEA, C. E. The treatment of thyroid crisis. *Minnesota Med.*, 25: 368, 1942.
38. SANFORD, F. E. Preoperative and postoperative treatment of the toxic thyroid. *Am. J. Surg.*, 62: 309, 1943.

Drainage following thyroidectomy is not necessary when all bleeding is carefully controlled. When considered necessary, a rubber tissue drain to be removed in twenty-four hours is sufficient. Rarely, excessive bleeding with impending shock may require packing of the wound and secondary closure.

From "Operations of General Surgery" by Thomas G. Orr (W. B. Saunders Company).

EXPERIMENTAL TRANSMISSION OF LYMPHOGRANULOMA VENEREUM VIRUS THROUGH THE PLACENTA*

HUGO HELLENDALL, M.D.
NEW YORK, NEW YORK

THE venereal diseases, gonorrhea and syphilis, increase under wartime conditions. The same may be expected with lymphogranuloma venereum, which is therefore of great special interest to public health.

Moreover, lymphogranuloma venereum is a disease which, as Pollard and Hellendall[1] have lately demonstrated, can offer a very difficult task to both the obstetrician and the surgeon, by the formation of an extraordinary stricture of the rectum, resulting from the development of a big mass of perirectal connective tissue and its ulceration. Rupture of the rectum during delivery and death of the mother and the newborn child were the result.

It is known that the virus of lymphogranuloma venereum can invade the blood stream.[2] Therefore, it seems to be of great common interest to investigate the hitherto unanswered question if lymphogranuloma venereum is hereditary, or if it can be transmitted through the placenta to the fetus.

Since the observation of Wilhelm Frei in 1925, concerning antigen antibody relationship in lymphogranuloma venereum and the subsequent use of the specific skin test which bears his name, the disease has been found to be much more widespread than had previously been thought to be the case.

Lymphogranuloma venereum is not only a malady of the tropics, but it has also been demonstrated with almost equal frequency in the temperate zone. That this is true, may be judged from the reports which have come from the United States (Thompson), from Germany (Reiter), and from France (Vignes). A statement has even been made by the last mentioned author that lymphogranuloma venereum is the disease of the future.

Because this virus infection has shown itself to be particularly chronic in character and destructive and debilitating in its course in women, the question of possible transmission from the mother to the newborn has assumed definite importance. In 1936, Dick, in Prague, observed a positive Frei test reaction in a fourteen-day old infant and suggested that the possible intrauterine transmission of lymphogranuloma be investigated.

In 1942, the author[3] published a preliminary report of an investigation dealing with the experimental transmission of the lymphogranuloma virus through the placenta of mice. Two methods of inoculation of pregnant mice were practiced: (1) subcutaneous and (2) intracerebral. In both series a fixed mouse strain of lymphogranuloma virus was injected in dilutions of 1:10. These animals were sacrificed twenty-four, forty-eight, seventy-two and ninety-six hours after the injections, or after they had gone to term and kindled. At these periods emulsions from the brains of both mother and offspring were injected into other mice. Part of the material so injected was made up into antigens in the usual manner, heating for three hours at 58°C. The antigens were than injected intradermally into human beings, and the results compared with human antigen or lygranum. Of the fifty-three human cases tested in the first report, thirty of the thirty-seven cases gave a positive reaction with the fetal antigen, while control inocu-

* From the Departments of Pathology and Bacteriology, College of Physicians and Surgeons, Columbia University, New York City.

lations with extracts of normal adult mouse brains were negative. Table 1 indicates that lymphogranuloma venereum was present in the brains of the embryos.

Figure 1 shows positive skin tests from a lymphogranulomatous mother animal brain and fetus brain emulsions in a human being with a positive Frei test when a total extirpation of the uterus of two pregnant mother mice had been made. I call attention to the fact that the two mother brain reactions were stronger than the fetus brain reactions.

Figure 2 shows positive skin tests four months later in the same human being from a lymphogranulomatous brain emulsion from a mother animal and its offspring, killed immediately after delivery.

The diameter of the papule of these antigen reactions has been measured with an arrow boby millimeter gauge, which dentists are accustomed to use, and which may be recommended for our purpose of measuring also.

A. W. Grace[4] "made easily accurate measurements with a thin, flexible scale, by intending the periphery of the papule at 90 degree intervals, with the nail of the palpating finger . . . it was his custom to take two diameters of the papule, each at right angles to the other."

Bodies similar to elementary bodies of lymphogranuloma were found in the brains of the offspring. The conclusion was reached that lymphogranuloma virus is transmitted, in the case of mice, through the placenta into the fetus. Later, there will be described a striking lymphogranulomatous skin change of the lower abdomen of a mouse, 7.5 months after delivery from an infected mother.

The present communication represents an extension of our previously published observations. The work was planned with three questions in mind: First, can we confirm our previous results with Frei tests in human beings? Second, can the initial and elementary bodies of the lymphogranuloma virus be found in the smears and tissues of the fetal brain? Third, will antigens prepared from the brain from an intracerebrally infected mouse give a positive Frei test, when injected into the skin of an apparently healthy offspring of an infected mother?

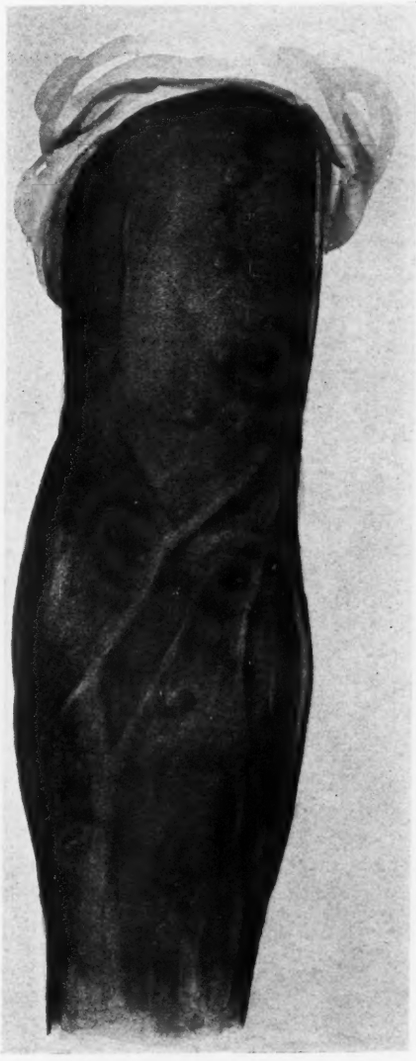
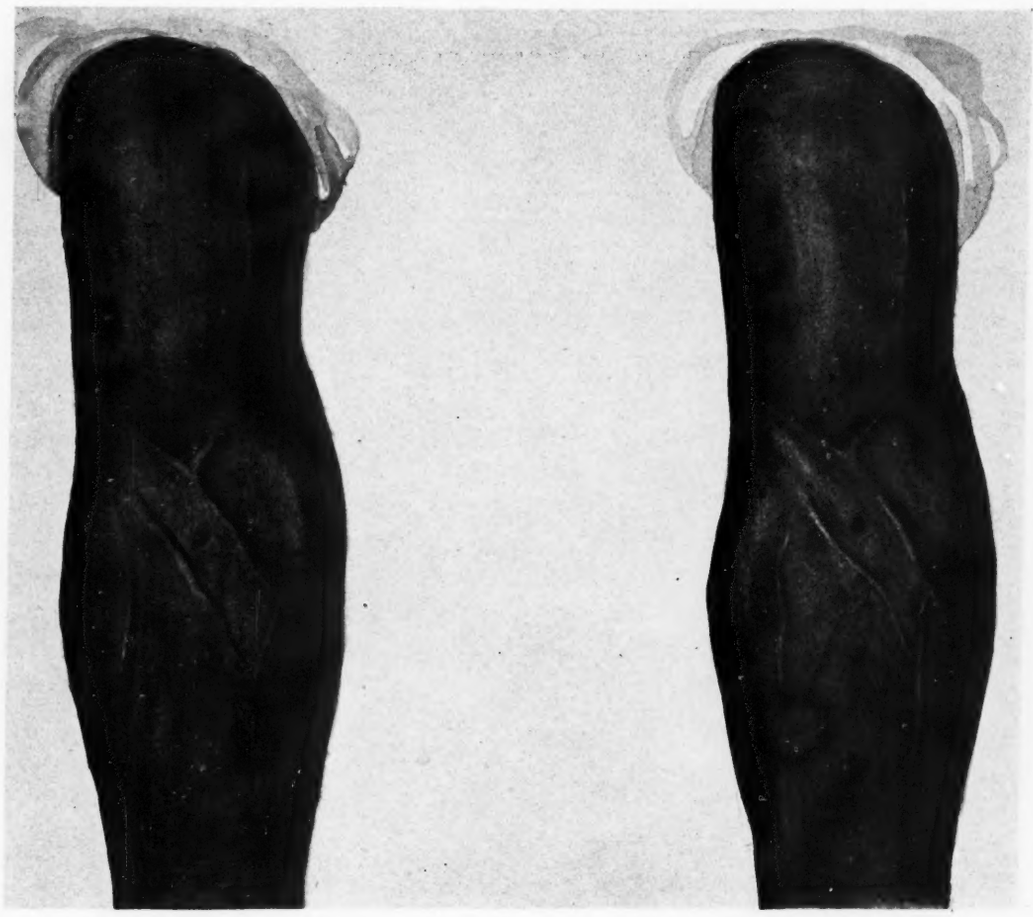


Fig. 1. Shows positive skin tests from lymphogranulatomatous fetus and mother-brain emulsions in a human being with a positive Frei test, when a total extirpation of the uterus of two intravenously infected pregnant mother mice has been made. The upper papule is the reaction of emulsions of the fetus; the second is the mother-brain reaction after twenty-four hours: the third papule is the reaction of emulsions of the mother brain and the fourth shows reaction of the fetus brain after forty-eight hours; the lowest papule is the human antigen reaction on the forearm (Frei test).

We have carried out eight experiments of inoculation into pregnant mice with six subcutaneous, one intravenous and one intracerebral injection of lymphogranuloma virus. Our whole material amounts to twenty-seven infected pregnant mice. An aseptic total extirpation of the pregnant uterus was performed in fifteen cases after infection, and deliveries occurred in twelve cases after infection. Ten extirpations and three deliveries have been published.

Total extirpation was done aseptically shortly before term, i.e., twenty-four hours. forty-eight hours and three to seven days after the infection. The uterus was placed in a sterile Petri dish and the fetuses were cut out in the following manner:

To eliminate the contamination with the mother blood from the wall of the uterus and with the maternal blood of the placenta, we removed the amnion with the fetus in it, took the fetus out and poured over the skull of the fetus 5 per cent iodine and then 75 per cent alcohol. We removed the capsule of the skull and took the brain out. Surface sterility tests and brain smears were made for microscopic examination of elementary bodies, and emulsions were made for antigens. Newborns, a few hours after delivery, have been killed and the



A B

FIG. 2. Showing positive skin test from lymphogranulomatous brain emulsions four months later in the same human being as in Figure 1, from a mother animal and offspring killed a few hours after delivery when a subcutaneous injection had been made. In A, the top papule is the reaction of emulsions of a newborn brain; the second is that of a mother brain from a normal mouse; the third papule is the reactions of emulsions of a newborn brain, and the fourth is that of a mother brain from an infected mouse. A shows reaction after forty-eight hours; B shows reaction after ninety-six hours.

brains have been removed, after disinfection of the skull with 5 per cent iodine and 75 per cent alcohol.

Besides that, nineteen fetuses after an aseptic total extirpation and eight newborns, a few hours after delivery, have been thrown in Bouin-or-Zenker solution for tissue staining with hematoxylin eosin.

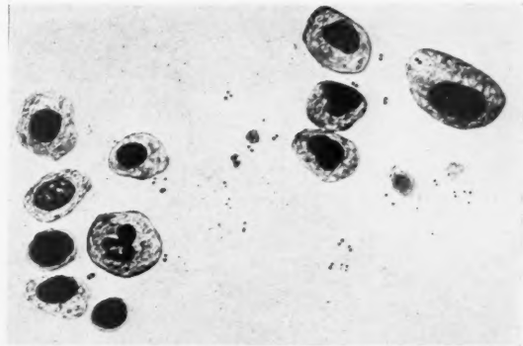
The nineteen fetuses, after total extirpation of the uterus, belonged to a subcutaneous, an intravenous, and an intracerebral inoculation of mother animals. The newborns belonged to three different subcutaneous experiments.

Hyperemia, hemorrhages and round-cell collections have been found in the pia mater, the plexus chorioides, and in the surface of the brains and spinal cords of the fetuses and newborns immediately after delivery. In one case of a fetus brain, eosinophiles have been seen in the meningeal exudate; in another case of a newborn, in which the animal was killed immediately after delivery nine days after inoculation, polymorphonuclear elements have been found.

From the foregoing facts, it can be concluded that a cerebrospinal meningitis has been established in the brain of the fetuses, even before delivery.

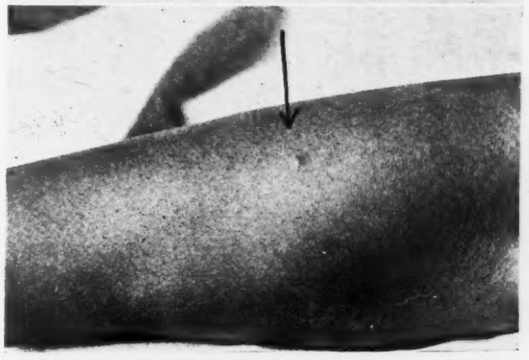
One hundred eight fetus brains, after total extirpation of the uterus, were used for antigens. In two different experiments with total extirpation of the uterus, elementary bodies were found six times, and initial bodies and elementary bodies were found five times in the smears from different transmissions of these fetus brain emultions into the brain of mice or into the yolk-sac.

With the antigens from fetus brains after total extirpation, we had forty-one positive Frei tests with thirty-six positive fetal tests on human beings, and fourteen negative Frei tests with fourteen negative fetal tests, proving that in these cases the virus lymphogranuloma was in the brain of these fetuses before delivery. (Table 1.) On the basis of these findings, the conclusion of the transmission of the lymphogranuloma virus via the placenta into the fetus of mice seems to be justified.



3

4



5

Fig. 3. Initial bodies in the brain tissue of a dead offspring after subcutaneous injection of a pregnant mouse with lymphogranuloma virus (Giemsa stain).

Fig. 4. Initial bodies in the brain smear of a sick offspring from the same experiment as in Figure 3 (Giemsa stain).

Fig. 5. A positive skin test in a lymphogranulomatous patient with emulsion from the brain of an infected offspring. The patient also gave a positive Frei test with the usual antigen.

If these fetuses had not been taken out by total extirpation but had been born, we would expect that these offspring would have had the lymphogranuloma venereum disease after delivery; and they would have shown sickness and death, elementary bodies in the brains, and positive brain tests of these offspring in human bodies with positive Frei tests.

We quote here Erich Traub:[5] "The detection of virus in the brains of newborn mice is regarded as an indication of intrauterine infection, because the time elapsing between birth and the test was too short for contact infection."

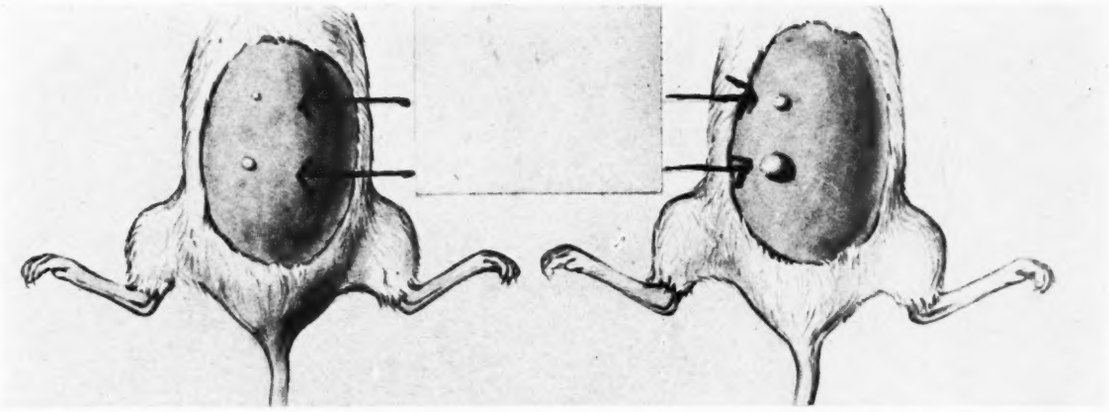


Fig. 6. Fig. 7.

Fig. 6. The same tests as in Figure 7 in a normal mouse were negative.

Fig. 7. The papule above shows a negative test with a normal fetus brain emulsion as control. The papule below shows a positive Frei test in the abdominal wall of a male offspring from an infected lymphogranulomatous mother mouse seven and one-half months after delivery.

Table 1

ANTIGENS FROM FETUS BRAINS AFTER TOTAL EXTIRPATION

Frei Tests, Positive	Fetal Tests, Positive	Fetal Tests, Negative	Frei Tests, Negative	Fetal Tests, Negative	Fetal Tests, Positive
41	36	5	14	14	

Per cent 87.8.

ANTIGENS FROM NEWBORNS IMMEDIATELY AFTER DELIVERY

Frei Tests, Positive	Newborn Tests, Positive	Newborn Tests, Negative	Frei Tests, Negative	Newborn Tests, Negative	New born Tests, Positive
53	46	7	18	15	3

Per cent 86.7.

We call attention to the following data of the clinical pictures of ninety-four offspring from a total of twelve deliveries two to six days after subcutaneous lymphogranulomatous infection of the mother mouse: twenty-seven offspring in four cases were all very sleepy a few hours after delivery; two of five offspring in one case have been found dead a few hours after delivery; they were probably born dead; three offspring in two cases were very sick forty-eight hours after delivery; one of five offspring *died* in another case forty-eight hours after delivery; four offspring of the same case died in three days after delivery; two of nine offspring died in another case twenty-four hours after delivery, the other seven were strikingly sleepy; four of these seven were killed forty-eight hours after delivery and three died in four weeks after delivery. One delivery happened twenty-four hours after injection with large offspring, proving that it was likely at the end of term. The delivery happened twice forty-eight hours after infection; once three, six and ten days after infection and twice four and five days after infection. Because the offspring were sick a few hours after delivery or probably dead at the time of delivery, it is to be assumed that they had acquired the disease before delivery.

The clinical picture immediately after delivery corresponds with the findings of elementary bodies in the brains of these newborns and of positive skin tests with the brain antigens of offspring.

In five of the twelve deliveries of two different subcutaneous experiments, in which the newborns were killed immediately* after delivery, initial bodies and mostly elementary bodies were found in the smears of the brains of the newborns of four mother animals, as well as in the brains of their transmissions in mice five times, and in the yolk sac transmissions from these newborn brains twice.

In eight of twelve deliveries the newborns have been killed a few hours after delivery. Forty newborn brains were used at once* for antigens. With the antigens from the brains of these newborns, killed immediately after delivery, we had fifty-three positive Frei tests with forty-six positive newborn tests on human beings, and eighteen negative Frei tests with fifteen negative and three positive newborn tests.

If we take a look at Table 1 we have the striking result: Antigens from fetus brains after total extirpation gave a positive fetal test in 87.8 per cent and antigens from newborn brains (at once after delivery) gave a positive offspring test in 86.7 per cent, showing almost the same result.

Tests with fetal mouse liver antigens from total extirpation of the pregnant uterus, made twenty-four hours after subcutaneous infection of the mother animal, have also been made three times in human beings. In two cases with positive Frei tests the fetal liver tests were negative; in one case of a weak positive Frei test the liver test was doubtful. Tests with new born mouse liver antigen made at once after delivery, but ninety-six hours after subcutaneous infection of the mother animal, have also been made in human beings.

In eight cases with positive Frei tests we observed seven positive and one negative liver test. A normal liver emulsion served in five of them as a striking control. Five of the seven liver tests correspond with the newborn mouse brain tests simultaneously carried out. In two cases no newborn brain tests were made. In two cases the liver tests were stronger than the newborn brain tests. In one case, with a doubtful Frei test, the liver test was doubtful, too.

* The words "immediately" and "at once" are used interchangeably but both designate a few hours.

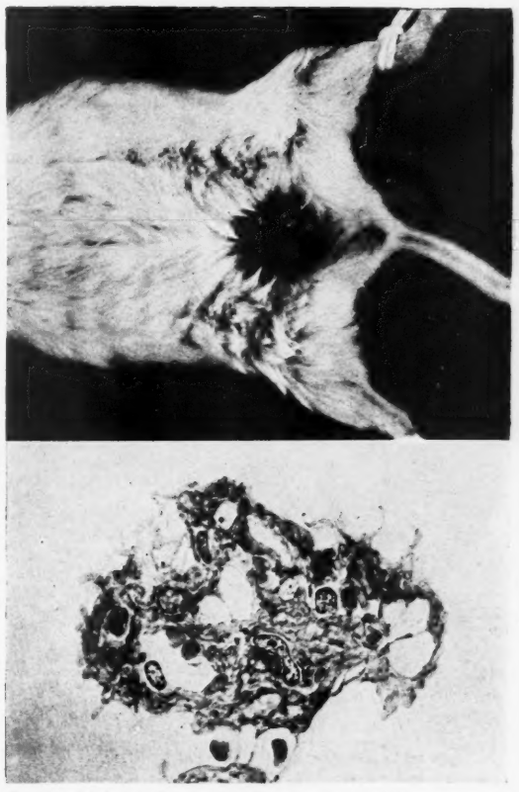


FIG. 8. A lymphogranulomatous swelling around the penis in a male offspring seven and one-half months after delivery from a lymphogranulomatous mother.

FIG. 9. Elementary bodies in the subcutaneous tissue of the skin.

In removing the liver of the fetus as well as of the newborns, respectively, we have applied the same antiseptic measures against infection as described above.

The difference in the two groups may be dependent upon the time after infection. If the virus has been developed in the body of the pregnant mouse ninety-six hours after infection, as in the first place, the effect of the antigen on the human body may be much stronger than if the time of development was only twenty-four hours after infection, as in the second place.

Because the liver of the fetus is nearer to the maternal blood by way of the vena umbilicalis than the brain of the fetus, it may be that the virus may develop earlier

in the liver than in the more distant fetal brain during the fetal circulation.

It has been shown that newborn mice,

FIG. 10. A positive test of this skin material in a patient with lymphogranuloma. There was also a positive Frei test in this patient.

after lymphogranulomatous infection of a pregnant mouse, not only were very sick immediately after birth but also demonstrated at once a number of tests characteristic of lymphogranuloma venereum.

The conclusion is, therefore, justified that the lymphogranuloma virus had been transmitted via placenta to the newborn before delivery, a result which we have reached already by investigation of the fetus in the uterus by total extirpation of the pregnant uterus after lymphogranulomatous infection of the mother animal.

If that is correct, the conclusion is also justified that four offspring of another experiment of the same kind which were killed for lymphogranulomatous tests forty-eight hours after delivery and five days after infection of the mother animal, were also born with the lymphogranuloma virus in them.

Summarizing, (1) the clinical picture of the other offspring of the same delivery had shown nine sleepy newborns at the delivery; death of one newborn twenty-four hours and of one forty-eight hours after delivery and death of the other four weeks later. (2) The skin tests with the offspring antigen and their two transmissions were positive in two cases with positive Frei tests. (3) The brain smears showed initial bodies. (Fig. 2.) (4) The clinical picture of the intracerebral transmissions I, II, and III in other mice showed sickness and death.

We are entitled to the same assumption that offspring from another delivery forty-eight hours after infection in the same experiment in which all three offspring died shortly after delivery, the last one three days after delivery, which showed initial bodies in the brain tissue of this offspring, have been born with the lymphogranulomatous virus in them.

The method used in the previous experiments was modified in that the virus used for the inoculation of pregnant mice was grown in the yolk sac of chick embryos. I shall describe one of the several experiments, all of which gave approximately the same results. Three pregnant mice received subcutaneously 0.5 cc. of a 1:10 lymphogranulomatous venereum egg yolk emulsion. Animal No. 1 was delivered 120 hours after the injection, but had killed and eaten the young mice within forty-eight hours. Animal No. 2 was delivered seventy-two hours after the injection, and mouse No. 3 was delivered ninety-nine hours after the injection. The young of Nos. 2 and 3 survived.

A brain emulsion of one of the litter from No. 2 was made forty-eight hours after delivery, and similar emulsions were made from the two young mice from No. 3 four days after delivery. The emulsions were injected intracerebrally into twenty-one mice. Of these seven mice died spontaneously from two to six days after inoculation; five became ill and were killed to obtain material for further transmissions. Antigens from the young mice of this experiment were injected into nine human cases of lymphogranuloma venereum and controlled by the usual Frei tests. Nine positive Frei tests and eight positive mice reactions were obtained. In one lymphogranuloma case there was a positive Frei test and a negative mouse test. In one

other case with a negative Frei test there was a negative mouse test.

In another experiment two pregnant mice were injected subcutaneously. Five living mice were born to one forty-eight hours after inoculation but all died three days after delivery. A photograph of a drawing of the brain tissue of the last offspring, stained with Giemsa (Fig. 3), shows the initial bodies which were present. The other pregnant mouse gave birth to nine living but strikingly sleepy, drowsy young offspring, five days after the subcutaneous injection, but two were dead at the end of forty-eight hours. The other seven appeared drowsy, and three died four weeks later. Initial bodies were found in the brain of one drowsy young mouse which was killed forty-eight hours after delivery. (Fig. 4.) An antigen prepared from the brain of this last mouse gave a positive reaction (Fig. 5) in a human case who had previously given a positive Frei test, and a negative reaction in an individual who previously gave a negative Frei test.

Rake and his collaborators[6] have recommended the use of the yolk sac of the chick to establish the presence of the elementary bodies. It was possible for me to show that initial bodies and elementary bodies increase in the yolk sac following the inoculation of lymphogranuloma mouse brain emulsion.

A lymphogranuloma mouse brain emulsion was passed twice intracerebrally. (Tr. 1 and Tr. 2.)* The mouse brain emulsion from the second transfer was inoculated into two eggs and both embryos were dead after forty-eight hours. The yolk sac emulsion (1:4) was injected subcutaneously into six pregnant mice. Only two of the deliveries are reported briefly here: one twenty-four hours after injection, another six days after the injection. A Frei test on the abdomen of a male mouse from this last delivery with 0.05 cc. of injected material was made on June 9, 1943, and was positive after forty-eight hours. It caused a large papule with a diameter of 6 mm. (Fig. 7) while the control papule was only 3 mm. in diameter. (Fig. 6.) Three other characteristic reactions were observed in mice of the same delivery. Two papules suggestive of a positive Frei reaction were obtained. The antigen papule measured 5 mm. and the control tests measured between 1 to 2 mm.

From the first delivery which occurred twenty-four hours after inoculation of the mother, five living mice were born, one of which died forty-one days later. The remaining four were ill on the fifty-first day, but did not die. One of these male mice showed an area without any hair, about 1 cm. in diameter, around the swollen penis, and three nodules with infiltration of the skin to the left of the penis. (Fig. 8.) The swelling was excised and one-half used for microscopic examination and the other half to make an antigen.

The microscopic examination of excised tissue showed chronic induration and hyalinization of the subcutaneous connective tissue with infiltrates of plasma cells, polymorphonuclear cells and eosinophiles. Cellular infiltrations of the wall of the vessels and hyalinization of the adventitia of the smaller vessels were occasionally found. No bacteria were found in sections of the tissue stained with methylene blue, Brown stain, or Gram stain; but elementary bodies were found in the subcutaneous tissue by the use of Giemsa stain. (Fig. 9.) An antigen from the skin gave a positive skin test in a single human lymphogranulomatous patient (diameter 9 mm.). (Fig. 10.) With material from the same mouse skin another positive test (diameter 6 mm.), with a fairly large papule, has been obtained in a new human case with a large lymphogranulomatous swelling in the right inguinal region. This patient also gave a strong Frei test (diameter 9 mm.) with a human antigen, while the control was negative.

If offspring in a later stage after delivery show lymphogranulomatous symptoms after evidence has been shown of congenital lymphogranulomatosis in other

* Tr—transmission.

offspring of the same, or other experiments of the same kind, the assumption seems to be clinically obvious that these lymphogranulomatous symptoms of the disease come also from a transmission of the virus through the placenta.

In five of six pregnant mice of a subcutaneous experiment, sufficient evidence for the transmission of the lymphogranulomatous virus through the placenta could be given. Of the sixth animal, five living offspring were born twenty-four hours after inoculation. One was dead after forty-one days; one was killed after five months. Transmissions in four mice were positive; one Frei test with Tr. 1 was negative.

Three offspring were still living seven months later. One mouse demonstrated a positive Frei test on its abdomen after eight months. One skin test from the swelling around the penis of a second of these offspring was twice strongly positive seven and one-half months after delivery.

We cannot exclude the possibility of the infection of these offspring by contact with the nasal secretions, the urine of the mother animal, and the maternal blood of the placenta. The port of entry of virus appears to be the nasal mucosa rather than the gastrointestinal tract. The question of contact infection by sucking of the mother's milk should be investigated, and we have already begun to do this. The fact that the milk-sucking in mice is ordinarily unsuccessful before the fifth or sixth day after delivery seems to be important.

Larger animals should be investigated to see if the amnion is permeable for the lymphogranuloma virus.[7] If that could be answered in the affirmative, a contact infection already in the cavity of the amnion before delivery could also be possible.[7]

The assumption that a number of fetuses during their intra-uterine living with lymphogranuloma virus were free of virus could be proven only when all the tests in certain offspring, tested separately immediately after delivery, were negative. That should still be done in other experiments with lymphogranuloma virus.

IS THE VIRUS OF LYMPHOGRANULOMA VENEREUM PERSISTENT?

W. Frei,[8] in his last article entitled "Combating Lymphogranuloma Venereum," which appeared in June, 1943, shortly after his death, summarizes as follows: "The question, whether in lymphogranuloma venereum persistence of positive reactions to cutaneous tests after recovery is due to a persistence of the virus, has not been decided yet, and should be investigated." And he gives a number of suggestions for research in this direction. To this research belongs the question of the importance of the Frei test in the child.

The same question arose in the course of our experimental work in the transmission of this virus through the placenta of mice especially during the study of offspring from the second and third delivery of the same infected mother mouse.

In a previous article[3] sufficient evidence was given of the experimental transmission of the lymphogranuloma virus through the placenta into the fetus of mice. A mother mouse had delivered twelve living offspring six days after subcutaneous inoculation with lymphogranuloma virus. Eight were killed a few hours after delivery, and brain emulsions, etc., were made. The offspring tests were twelve times positive in fourteen cases, when a positive Frei test was made. In three other cases with negative Frei tests, there were two negative offspring tests and one positive. Therefore, because the killing had been done immediately after delivery, the lymphogranulomatous virus must have been transmitted through the placenta. This originally infected pregnant mouse in the experiment conducted in October, 1942, had a total of three deliveries, and one female offspring of its first delivery also had three deliveries.

Now this question must be answered: Whether similar results could be established with offspring antigens from the *second* and *third* deliveries of this same mother mouse and the one female offspring,

Fig. 11.

Fig. 12.

Fig. 13.

Figs. 11 to 13. Show positive offspring tests from offspring brain emulsions of mother animal, second delivery. In Figures 11 and 12, starting from the left, the one papule is the control; the two papules following are the reactions. In Figure 13 the upper papule is the control; the lower two are the reactions.

which also had three deliveries during this period.

On January 6, 1943, the same mother animal had a second delivery of nine sick living young. On January 12th, six days after the second delivery, six living offspring were killed for brain emulsion. On March 1st, the third delivery by the same mother animal took place; three living young were born. All three were killed eighteen days after the third delivery. On March 24th, the mother animal was dead.

Because the offspring of these deliveries were killed one week after the second delivery and two and a half weeks after the third delivery, the lymphogranulomatous virus may have been transmitted here by another source of infection and not by the placenta.

We could advance the same argument in all three deliveries of the offspring animal (October 12, 1942; January 12, 1943; March 1, 1943), in which not immediately after delivery, but (1) sixteen days after first delivery, 4 offspring were killed; (2) seven days after second delivery, nine offspring were killed; and (3) eleven days after third delivery, seven offspring were killed.

It will now be shown in Table II what results were obtained from the offspring tests of the second and third deliveries of the mother mouse, and what results from the offspring tests of the three deliveries of the female offspring from the first delivery of the mother mouse. (Figs. 11 to 18.)

We have made thirty-eight tests on human beings with offspring antigens from the second and third deliveries of the mother mouse, and from her female offspring's three deliveries. Twenty-eight of these cases gave positive Frei tests, ten gave negative Frei tests. (Table II.)

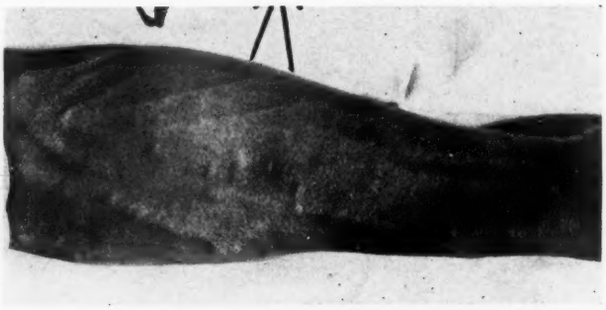


FIG. 14. Shows negative offspring test from mother animal, third delivery. The papule at the left is the control; the papules marked with a combined line to the right are the reactions.

To sum up, it has been shown that (1) the offspring tests from the first delivery of an infected pregnant mouse (Exp. Sept., 1942) were twelve times positive in fourteen cases with a positive Frei test; (2) the offspring tests of the second delivery of the same mother mouse and the offspring tests of the first and second deliveries of the female offspring of the same mouse were positive sixteen times in twenty-eight cases with a positive Frei test. This striking fact seems not to be the effect of a passive transmission of immune bodies, but of the transmission of a living virus. If the offspring tests of the third deliveries show weaker results (Table II), is it likely that in the third delivery the virulence of the lymphogranuloma virus is decreasing? The death of the mother mouse a week after its third delivery speaks against this theory.

The surface sterility tests of all the brains were sterile without exception. The clinical pictures, however, of forty-two mice with three or four intracerebral transmissions of the offspring brain emulsions from the six different deliveries of the mother and of the offspring were not strikingly different from each other. The offspring brain emulsions of the six de-

liveries in their intracerebral transmissions produced sickness or death after forty-eight hours or later with very few exceptions.

We have made the same observations with four other mother animals in two different experiments. Three of them had three deliveries; one, only two. There was

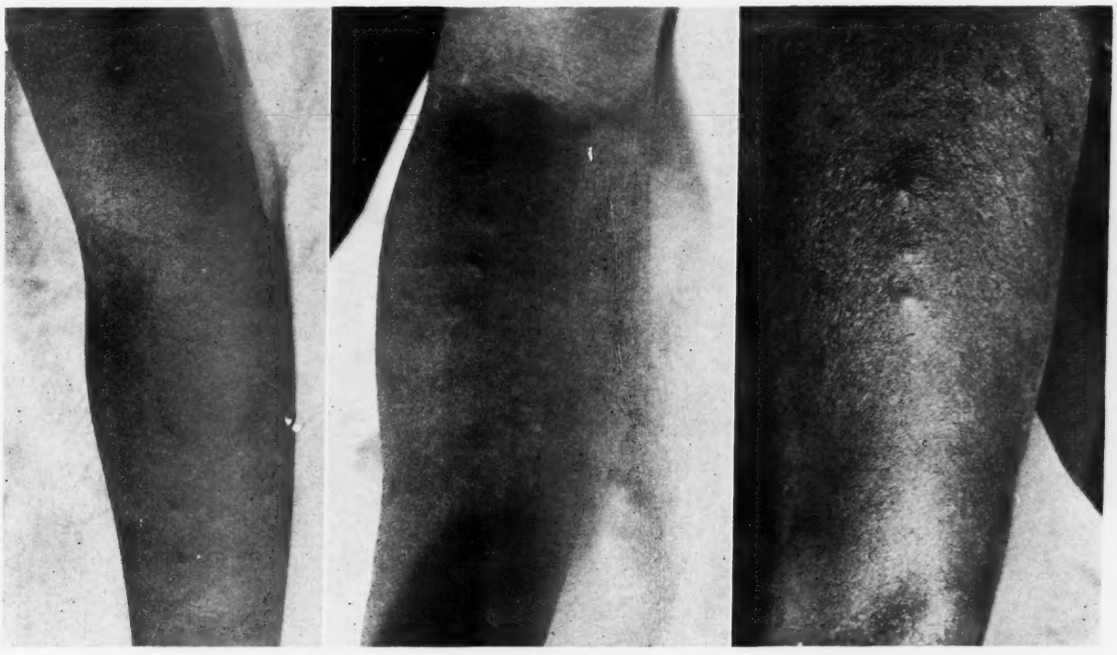


Fig. 15. Fig. 16. Fig. 17.

Figs. 15 to 17. Show positive offspring tests from offspring brain emulsions of female offspring, first and second deliveries. In all three illustrations the single upper papules represent the controls; the two lower papules the reactions.

In this respect, the death of another *mother* mouse in the same experiment is instructive. It was first delivered six weeks after inoculation; the second delivery occurred four weeks later. The animal died four weeks after the second delivery.

no delivery by the one female offspring. The time between the first and second delivery of one animal was one month; of the second, four and one-half months; of the third, five months. Between the first and third deliveries there was an interval

TABLE II

ANTIGENS OF OFFSPRING BRAINS FROM FIRST, SECOND AND THIRD DELIVERIES OF MOTHER MOUSE AND OFFSPRING

		Frei Test, Positive	Offspring Test			
			Positive	Positive Weak	Question	Negative
Mother animal #3	Del. 2 and Tr. 1	9	4	2	1	2
Female offspring of mother animal #3	Del. 3	5	..	..	..	5
	Del. 1 and Tr. ½	6	6			
	Del. 1 and Tr. ¾					
	Del. 2 and Tr. ½	4	4			
	Del. 2 and Tr. 3					
	Del. 3 and Tr. ½	4	1	..	..	3
	Del. 3 and Tr. 3					

of two and one-half months, five months and seven months, respectively.

The offspring of one mother animal were

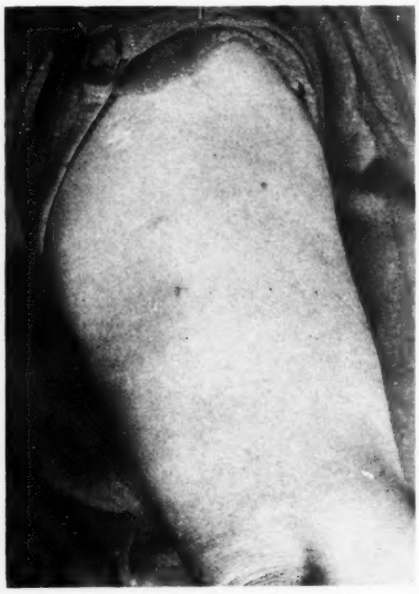


FIG. 18.* Shows a negative offspring test from mother, second delivery, in a case with a negative Frei test. The upper papule is a negative Frei test reaction, and the lower papule is a negative offspring reaction.

killed immediately after a second delivery, and of two mother animals after third deliveries. In the other three mother animals, some of the offspring were killed two, seventeen, and twenty-five days; and some five months after the first, second, and third deliveries.

These facts and their positive tests, which are similar to the above mentioned, give further evidence of the transmission of lymphogranuloma venereum through the placenta, since three groups of offspring have been killed immediately after the second and third deliveries. The facts show also the dangerous persistency of the virus through the second and third deliveries of the mother and offspring.

Frei tests also appeared to be positive in the abdomen of the young of the second delivery, three times from two different experiments. In this respect, I may mention again the record of a case in this article, in which a lymphogranulomatous swelling arose in the abdominal skin around the penis of a seven and one-half-months old mouse, in a case in which the mother mouse had been infected subcutaneously with lymphogranulomatous virus.

These experimental results suggest the danger which possibly threatens the newborn child of a lymphogranulomatous mother. These facts have also important relationship to the Frei test in childhood, when the lymphogranulomatous mother has given birth to offspring. Levy[13] asks: "Is a positive test in early infancy merely an indication of immune bodies transmitted through the placenta? *If so, will the Frei test become negative later*, or will the disease

TABLE III

		Frei Test, Negative	Offspring Test			
			Positive	Positive Weak	Question	Negative
Mother animal #3	Del. 2 and Tr. ½	3	..	..	..	3
	Del. 3 and Tr. 1	1	..	..	..	1
Female offspring of mother animal #3	Del. 1 and Tr. ½, ¾	2	1	..	..	1
	Del. 2 and Tr. ½, 3	4	..	..	1	3

Note: Del. means delivery; Tr. means transmission.

* Measurements of the tests in Figs. 11 to 18: Fig. 11: 0, 3:0, 5:0, 5—Control. Fig. 12: 0, 4:0, 6:0, 7—Control. Fig. 13: 0, 3:0, 7:0, 8—Control. Fig. 14: 0, 3:0, 3:0, 3—Control. Fig. 15: 0, 4:0, 6:0, 6—Control. Fig. 16: 0, 3:0, 7:0, 7—Control. Fig. 17: 0, 4:0, 6:0, 7—Control. Fig. 18: 0, 2:0, 3—Control.

become manifest clinically at a later age?". The answer is that the disease in early infancy, with a positive Frei test, may possibly manifest itself clinically at a later age.

We have yet to describe the fate of eighteen living offspring, in two subcutaneous experiments, which were left with the mother animal after delivery. We believe that in all these cases the lymphogranuloma virus was transmitted through the placenta. That they were infected with lymphogranuloma virus is evident from the following facts: Six offspring were born three to nine days after inoculation; one offspring was dead three days after delivery; one was killed two days after delivery; two were killed four days after delivery, and two were eaten by the mother animal ten days after delivery. Skin tests of the offspring were positive; elementary bodies were found; intracerebral transmissions showed sickness and death of other mice.

Two living offspring by another animal were delivered in another subcutaneous experiment four days after infection; they were killed two months later. Three transmissions in mice showed sickness and death with six positive skin tests of the offspring as well as initial bodies. Three yolk sac transmissions from offspring brains showed sickness and death of the infected eggs and elementary and initial bodies in the yolk sac.

In another case, the infected mother animal of the last experiment was not pregnant, but delivered five living offspring five months later; these were killed ten days after delivery. The mice on which an intracerebral transmission was made were sick two, six, and eight days after transmission, then recuperated.

The question as to whether in all these different cases the lymphogranulomatous virus was transmitted through the placenta, I should like to answer in the affirmative, because the whole clinical picture as one essential test, the controls, and the virus tests are in accordance with each other.

Five living offspring were born twenty-four hours after subcutaneous infection of another animal. One offspring died forty-one days later. The remaining four were ill on the fifty-first day, but did not die. One was killed five months later. The offspring test in a human being was negative, but three intracerebral transmissions showed sickness and death of the animals on which transmissions were made. One of two offspring eight months later showed a positive Frei test in the skin of the abdomen; one offspring showed a lymphogranulomatous swelling around the penis.

We have to assume that because the mother animal was delivered twenty-four hours after subcutaneous infection, the effect on the fetus through the placenta in this case would not be great. Therefore, it is to be understood why one of five offspring died five weeks later, and four survived from five to seven and a half months.

The above mentioned negative offspring test in a human being with a positive Frei test is in interesting contrast to a positive Frei test in the skin of the abdomen of one of the supposedly healthy offspring, and seems to demonstrate the latency of the lymphogranuloma virus.

It may be objected that after transmission of the virus through the placenta the offspring may recuperate and later new lymphogranulomatous developments could be caused through a new inoculation by contact. But the fate of the living offspring shows clearly the persistency of an active virus. Active virus protects, however, against a second inoculation of the same virus, according to Rivers[10] and Bieling.[11] Bieling says, "In the course of the lymphogranulomatous disease, a resistance against a venereal infection with living virus develops."

The following review of the literature will show that the question of any hereditary or congenital transmission of the lymphogranuloma virus in childhood is not decided yet.

William Dick,[9] in Prague, reported in 1936 the case of an infant whose parents had this disease, and who showed a positive Frei test at the age of two weeks and again at five months with no clinical symptoms of lymphogranuloma virus.

Before Dick, in a discussion before the American Medical Association in 1934, John Eric Dalton[12] answered a question of Walter S. Grant about experiences with positive Frei tests in children in the case of lymphogranulomatosis in mothers, as follows: "I have had the opportunity to study two children, born of mothers who suffered from acute lymphogranulomatosis inguinale. The acute glandular process in one of the mothers occurred just preceding conception, while in the other it appeared during pregnancy. In each case, the child has been watched with periodic Frei tests over a period of a year, with completely negative results."

Harold Levy[13] evaluated in 1937 nine cases of lymphogranuloma virus in childhood and reported an additional case. In a six-year old female colored child, painful swellings appeared in both groins. The Frei test was slightly doubtful for about three to four weeks then positive. The parents, who were both being treated for syphilis in another clinic, were discovered to have lymphogranuloma venereum after diagnosis was made in the child. Levy continues: "Until recently, direct contact was thought to be the only kind of transmission of the disease. Dick, however, reported the case of an infant whose parents had the disease, and who showed a positive Frei test at the age of two, and again at five months, with no clinical symptoms of lymphogranuloma venereum, although the positive test may have been a transmitted allergic reaction from the mother. This is unlikely in view of the persistently positive skin test."

Melczer and K. Sipos[14] reported the case of a three-year old daugher of a mother with elephantiasis genitorectalis. The child had a strong positive Frei test in intervals of fourteen days, but five months later the Frei test was absolutely negative. The authors believe, therefore, that the first results were not specific, and that this case cannot be evaluated as congenital lymphogranuloma venereum.

Melczer and Sipos refer to the cases of Ferrari,[15] Michelson, Crotty, and Kesselberg,[16] and Coutts-Moneta[17] with negative Frei tests of the newborn from lymphogranulomatous mothers, and they believe that the question of the intra-uterine infection of the fetus has not been clarified as yet, and that the occurrence of congenital lymphogranuloma venereum can be decided only by larger statistical material.

In 1940, Levy[18] reports an additional case of lymphogranuloma venereum in childhood and says: "The Frei test is not found until a period of three to eight weeks has elapsed from the time of infection. A temporary negative Frei test may occasionally be present, due to cutaneous allergy in certain cases of prolonged or relapsing lymphogranuloma venereum with lessened general resistance. Other reasons may be concurrent—early florid syphilis, chancroid, active tuberculosis, high fever, and occasional gonorrhea. False positive Frei tests may result from antigen contamination with bacteria." Another reason is suggested in the following statement of Gregoria: "Specific sensitization may coexist with other diseases—syphilis, for example—and give rise to apparently nonspecific reactions in those diseases."

In 1941, V. Pereira and I. B. Gil[19] published a case of a girl eighteen months old and a photograph showing bilateral lymphogranulomatous swelling of this patient. There was a strong positive Frei test. The parents had a positive Frei test, too, and syphilitic papules. The authors believe that the child was extragenitally infected by the parents, lying with them in their bed. But there is no proof of this. It may be congenital or not.

According to Wilson and Hesselthine[20] the indusputable evidence of Dummer and Tamura,[21] Melczer and Sipos,[14] Sonck[22] and Levy[13,18] has established the juvenile

group. These authors emphasize that these cases are not congenital transmissions, but acquired infections after the natal day. These children developed the same type of syndrome as the adult.

C. Leon Wilson and H. Close Hesselthine[20] published "cases of nineteen babies born of and breast-fed by mothers with a latent lymphogranuloma virus who have been normal and free from the disease. Only one baby in thirteen cases showed any evidence of passive transfer of antigenic bodies. In spite of two positive tests (on the third and tenth days), the test became negative within three months, and so remained."

The authors pointed out that all of the mothers apparently were in the latent stage of the disease, and therefore probably non-infectious. They continue: "It would be worth-while, indeed, to find a sufficient number of pregnant women who had the disease in the *active* phase, particularly if one could prove a systemic manifestation in them. If *this* virus passed through the placenta, *much damage* could result; but again, the fetus, like the mother, might have little or no residual damage. If, on the other hand, the damage was severe, extensive, or lethal, an abortion or still-birth could be expected."

CONCLUSIONS

1. Additional data are presented showing that in mice the virus of lymphogranuloma venereum, when injected subcutaneously into pregnant mice, can pass through the placenta and infect the fetus.

2. Initial bodies and elementary bodies could be demonstrated in smears and offspring brain tissue.

3. A male offspring eight months after delivery from an infected pregnant mouse showed a positive Frei test in the abdominal wall.

4. A male offspring seven and one-half months after delivery from a pregnant mouse, infected with lymphogranuloma venereum material, presented changes in the skin of the lower abdomen which are attributed to intra-uterine lymphogranulomatous infection. The finding of elementary bodies in the subcutaneous skin tissue, and the positive Frei test obtained in two human patients with antigens from the skin emulsion of the mouse, are taken as proof that lymphogranulomatous infection has occurred.

5. The offspring tests from the first delivery of an infected pregnant mouse in the experiment were twelve times positive in fourteen cases with a positive Frei test.

6. The offspring tests from the second delivery of the same mother animal, and the offspring tests of the first and second delivery of the female offspring of the same animal were nineteen times positive in twenty-eight cases with a positive Frei test.

7. The offspring tests from the third delivery of the same mother (five) and offspring (four) were eight times negative in nine cases with positive Frei tests.

8. The surface sterility tests of forty-two mice, into which intracerebral transmissions of offspring brain emulsions from the six deliveries of mother and offspring have been made, were sterile without exception.

9. The clinical picture of these forty-two mice showed sickness and death forty-eight hours later, and only a few recuperated after intracerebral transmissions. In this respect, however, there was no striking difference between mother and female offspring between first, second, and third deliveries.

10. The fate of eighteen living offspring which had been saved for the mother animal after delivery has been described.

11. All this gives not only further evidence of the transmission of the lymphogranuloma virus through the placenta, as must be suggested in the three deliveries of mother and female offspring, when the offspring was killed a few hours after delivery, but also indicates the persistency of the virus.

12. The clinical question whether there is any occurrence of congenital lympho-

granulomatosis in human beings, should be studied with a greater amount of statistical material. We must then differentiate between the two groups of lymphogranulomatous women: (1) Mothers who were apparently in the latent stage of the disease, and (2) mothers who were in the active stage of the disease; that is to say, to investigate and find if there is a systemic manifestation in them. The last group especially would be of interest in this respect. Also the aforementioned suggestion of W. Frei for "research work on so-called latent forms" would be very helpful.

13. If such research work is to be done in the future, the question immediately arises whether it will be necessary to treat the disease of the human fetus in the uterus, of the newborn after delivery, or of the child at a later stage, and how this is to be done.

I am deeply grateful to Drs. M. Sanders, H. Curth, A. E. Braley, C. K. Smelser, W. Pyles, and Mr. A. Feinberg and Mr. H. Pebler for their friendly collaboration; and to Dr. J. G. Hopkins for his permission to make tests in the Department of Dermatology, Presbyterian Hospital, in New York City.

REFERENCES

1. Pollard, E. and Hellendall, H. Death due to intraperitoneal rupture of a strictured lymphogranulomatous rectum during parturition. *Am. J. Obst. & Gynec.*, 44: 317–324, 1942.
2. Ravault, P., Boulin, and Rabeau. Sur une variété de poradino-lymphite suppurée benigne a forme septicémique. *Semaine med.*, 42: 453, 1922.
Hellerström, S. and Wassen, E. (a) Cit. in *Ann. Inst. Pasteur*, 48: 82, 1932; Studien uber die Affinität des Lymphogranuloma inguinale virus zu verschiedenen Gewebsystemen bei Affen. (b) *Ztschr. f. Immunitätsforsch u. exper. Therapy.*, 73: 112, 1931–32. Rajam, R. V. Report of a fatal case of lymphogranuloma inguinale from meningo-encephalitis. *Brit. J. Ven. Dis.*, 12: 238, 1936. Coutts, W. E. Contribution to the knowledge of lymphogranulomatosis venerea as a general disease. *J. Trop. Med.*, 39: 13, 1936. Coutts, E. and Monetta, O. Hereditary transmission of lymphogranulomatosis venerea. *J. Trop. Med.*, 41: 299, 1938.
3. Hellendall, H. Experimental transmission of lymphogranuloma venereum virus through the placenta. *Proc. Soc. Exper. Med.*, 51: 140, 1942.
4. Grace, A. W. and Suskind, F. H. The use of a standard mouse-brain antigen. *J. A. M. A.*, 107: 1359, 1936.
5. Traub, E. The epidemiology of lymphocytic chorio-meningitis in white mice. *J. Exper. Med.*, 64: 183, 1936.
6. Rake, G. and Jones, H. B. Studies on lymphogranuloma venereum. *J. Exp. Med.*, 75: 323, 1942.
7. Hellendall, H. On the importance of infected amniotic waters by mother and child. *Beitr. f. Geburtsh. & Gynäk.*, 10: 320–374, 1906.
8. Frei, W. Combating lymphogranuloma venereum. *Arch. Dermat. & Syph.*, 47: 830, 1943.
9. Dick, W. 1st das Lymphogranuloma Inguinale auf die Nachkommenschaft übertragbar? *Med. Klin.*, 32: 319, 1936.
10. Rivers, T. M. Filterable Virus. P. 9, Chicago, 1928. Univ. Chicago Press.
11. Bieling, R. Viruskrankheiten der Menschen. P. 86, Leipzig, 1938. I. A. Barth.
12. Strauss, M. I. and Howard, E. The Frei test for lymphogranuloma inguinale. *J. A. M. A.*, 103: 1832, 1934.
13. Levy, H. Lymphogranuloma in childhood (review of the literature with a report of a case). *J. Pediat.*, p. 813, 1937.
14. Melczer, N. and Sipos, K. Zur frage der congenitalen Übertragbarkeit des L. Inguinale. Dermatologica. P. 163. New York, 1940. S. Karger.
15. Ferrari, A. V. *Bull. Soc. Reg. Soc. Ital. Dermat.*, 3: 301, 1937.
16. Michelson, I. D., Grotty, I. G., Kesselberg, L. A. Hereditary transmission of lymphogranuloma venereum. *Am. J. Obst.*, 35: 322, 1938.
17. Coutts, W. and Moneta, O. Hereditary transmission of lymphogranuloma venereum. *J. Trop. Med.*, 41: 279, 1938.
18. Levy, H. Lymphogranuloma venereum in childhood. *J. Pediat.*, 57: 441, 1940.
19. Pereira, V. and Gil, I. B. Lymphogranuloma venereum in girl 18 months old. *Arch. de pediat. d'Uruguay*, 12: 812, 1941.
20. Wilson, C. L. and Hesselthine, H. Close. Effect of I. v. on pregnancy, labor, and the fetus. *Am. J. Obst. & Gynec.*, 43: 459, 1942.
21. Dummer, C. and Tamura, I. *Med. Bull. Cincinnati* 7: 111, 1935.
22. Sonck, C. E. *Nord. Med.*, 5: 371, 1940.

THE USE OF THROMBIN (TOPICAL) IN TRANSURETHRAL RESECTION OF THE PROSTATE*

CLARENCE G. BANDLER, M.D.,
Director of the Department of Urology, New York Post-Graduate Medical School and Hospital

PHILIP R. ROEN, M.D.
Assistant Urologist, New York Post-Graduate Hospital

AND

RAYMOND STEPT, M.D.
Resident in Urology, New York Post-Graduate Hospital

NEW YORK, NEW YORK

TRANSURETHRAL resection of the prostate has long since become a standard surgical procedure, for which, however, the ultimate in instruments, technics and adjuvants to the surgery has not yet been reached. Periodically we find innovations and modifications introduced which simplify the procedure and increase the safety factor. The most recent addition to this field has been the use of Thrombin (Topical) as a hemostatic agent following the resection.

Heretofore one of the principal hazards of transurethral prostatic surgery has been postoperative bleeding and the difficulty in controlling it. Blood clots formed in the bladder necessitated frequent change of indwelling catheters and the use of rigid catheters and evacuating syringes. Not infrequently, the patient had to be returned to the operating room for evacuation of clots per urethram, or on occasion, suprapubic cystostomy for the removal of blood clots from the bladder had to be performed secondarily. To prevent this clot formation, bladder irrigations have been utilized intermittently or continuously. For the latter, various devices and multichanneled catheters have been employed; and at best, there is moderate difficulty in making these drain properly, thus causing considerable postoperative anxiety. In addition, various solutions have been employed, ranging from normal saline and boric acid for irrigation alone, to anticoagulants such as sodium citrate solution or to styptics such as alum solution.

No matter which of these various catheters, irrigating appliances or solutions were used, constant alertness was necessary, thus entailing a high degree of personnel attention and at times necessitating continuous nursing care for each patient following transurethral prostatic surgery. Added disturbance and discomfort to the patient were produced by the frequent irrigations which would occasionally cause severe vesical spasms, and become a torment to the patient. In addition there was the great factor of blood loss which might continue for a number of days following the operation and considerably retard the patient's convalescence and recovery, and which might necessitate repeated transfusions. It is a tribute to transurethral prostatic resection that among the many confusions mentioned here, and others, it has become a surgical measure of distinct merit.

It would then be a tremendous boon to have a method of controlling or, at least, modifying the major problem of bleeding following transurethral resection of the prostate. Such an agent, we believe, has been found in the use of Thrombin (Topical). We may well confess that in our early use of this preparation, we were extremely reluctant to abandon bladder irrigations,

* From the Department of Urology, New York Post-Graduate Medical School and Hospital, Columbia University, New York City.

for this appeared to be foolhardy and seemed to invite disaster. Nevertheless, after considerable trial, we can recommend this material as a potent agent in the control of the bleeding.

Two reports on the clinical use of Thrombin (Topical) have already appeared: the first report, that of O'Conor[1] presents his technic for the use of the Thrombin (Topical) and comments on his experience with the conclusion that it has been most satisfactory. Palomo[2] also cites a series of cases in which this preparation has been successfully employed. Our own presentation here is confirmatory of the satisfactory results obtained with Thrombin (Topical) in a group of fifty cases. Moreover, we have analyzed our results and compared them with an equal number of cases in which no Thrombin (Topical) was employed. This comparative group comprised those cases immediately preceding the clinical trial of Thrombin (Topical). All cases are from the one urologic service at the New York Post-Graduate Hospital and the patients were operated upon by the same individuals, so that, so far as we can ascertain, all conditions are the same, and comparisons are proper.

THEORY OF THE USE OF THROMBIN (TOPICAL)

Thrombin (Topical) is a highly purified extract of bovine blood, the allergenic factors for patients sensitive to beef proteins having been removed. In the normal clotting mechanism, thrombin, a product of the action of thromboplastin upon prothrombin in the presence of ionized calcium, acts upon fibrinogen to produce fibrin, which is the clot.

The clotting power of thrombin *in vitro* is quite remarkable, 1 mg. of the purest fraction being capable of clotting approximately 1½ liters of standardized fibrinogen solution in fifteen seconds. Whole blood is similarly responsive to its properties. Commercial thrombin has been standardized so that one Iowa unit is the amount necessary to clot 1 cc. of fibrinogen solution in fifteen seconds. The product is sensitive to heat and is destroyed at 52°C. and its activity is also destroyed by weak acids and alkalies. It is readily soluble in water, but solutions begin to lose their activity at room temperature after a day or two. The dry powdered preparation, however, is stable for years. Topical application to operative surfaces produces no untoward effect, *but it must not be used by intravenous injection,* for introduction intravascularly might easily result in fatal thrombosis. Its hemostatic effect when applied topically is dependent upon the formation of a thin adherent clot which forms on the surface of the bleeding tissue, *not within the vessels themselves.* It is best used upon a surface which has been washed relatively free of blood, for if a thick layer of blood is present, it tends to clot only the surface layers, permitting bleeding to continue beneath the surface. It may also be employed by spray or by flooding the area with the solution, or by gently rubbing the solution on the raw area with the gloved finger.*

METHOD OF USE

Our method for the use of Thrombin (Topical) in transurethral surgery has been quite simple. First it must be emphasized that our standards for resection technic have not been altered by its use; we look upon this preparation as an adjuvant in postoperative care, not as a short cut in transurethral resection. From our observations thus far, it may be said that in transurethral surgery of the prostate, we may expect Thrombin (Topical) to control venous and capillary oozing, but not arterial spurters or large open venous sinuses. With the confidence we have gained in its use, we are less apt to fall into the evil of over-coagulation with its frequently attendant, late secondary hemorrhage and prolonged periods of convalescence. Indeed, we believe strongly

*The material used was supplied unstintingly in ampuls of 5,000 and 10,000 units by the Department of Clinical Investigation, Parke, Davis & Company of Detroit, Michigan, to whom we are greatly indebted.

that the minimization of coagulation consistent with good surgery hastens healing and markedly lessens the late postoperative discomfort.

When resection of the prostatic tissue has been completed, and all arterial spurters have been coagulated, a number 24 F. Foley catheter with a 30 cc. bag is introduced and the bladder is irrigated until the return flow is quite clear. The catheter is then withdrawn until the eyes are in the prostatic urethra. Using an ordinary 10 cc. syringe with a Pomeroy ear tip serving as an adapter, 5,000 to 10,000 units of Thrombin (Topical) in 10 cc. of solution, are slowly injected through the catheter, following which 5 cc. of air are immediately injected to drive all the solution out of the catheter into the urethra. The catheter is clamped and allowed to remain *in situ* for *five minutes by the clock*, at the end of which time it is gently advanced into the bladder and the bag is distended. We have not found it necessary to depend upon any especially designed catheter with additional channels. The catheter remains clamped for forty-five to sixty minutes when siphon drainage into a bottle is established. Traction upon the catheter has not been necessary for control of bleeding and irrigations have been entirely abandoned. The drainage is characteristically dark brown or black and gradually becomes lighter in color until, in most cases, it is perfectly clear in eighteen to thirty-six hours after resection. Occasionally we have noted perfectly clear urinary drainage in as short a time as eight hours. Unless the procedure has been an obvious failure, a most unusual circumstance, there are no clots present in the drainage, and there is no clot formation in the bladder. Intravenous fluids are given postoperatively. Whole blood by transfusion is given when indicated, only if there has been serious blood loss during the operation. The catheter is usually removed twenty-four hours after the urine has become clear.

RESULTS

We have employed Thrombin (Topical) in fifty resections of the prostate for benign hypertrophy and carcinoma and have compared our results with the fifty resections immediately preceding in which bladder irrigations were used in the postoperative management. Table 1 briefly summarizes our statistics on tangible factors:

TABLE 1
COMPARISON OF CASES OF TRANSURETHRAL RESECTION OF THE PROSTATE IN WHICH THROMBIN (TOPICAL) WAS AND WAS NOT USED

	No. of Cases	Urine Clear (Hrs. after Resection)	Catheter Removed (Hrs. after Resection)	Postoperative Hospital Stay (Days)	Severe Postoperative Hemorrhage
No Thrombin employed...	50	52	71	8	5
Thrombin employed.....	50	27	48	7	1

It can be seen that in the patients treated with Thrombin (Topical) the urine was clear and the catheter could be removed in much less time than when irrigations were employed. The urine became clear in an average of twenty-seven hours and the catheter was removed in forty-eight hours in the former group, while in the latter, the urine cleared in fifty-two hours with removal of the catheter in seventy-one hours. The hospital stay was reduced slightly, but not very significantly, from an average of eight days to seven days. Other factors which can not be expressed in figures, however, were even more important. Bladder irrigations were eliminated entirely, reducing nursing care to a minimum. Exasperating experiences with plugged catheters were obviated except in one instance. Physical discomforts such as vesical spasm, occasioned by frequent bladder irrigations were completely absent and mental apprehension was reduced to a minimum by the elimination of a for-

bidding irrigating apparatus or frequent attention to the catheter. Patients fared much better with the least attention consistent with their postoperative course. The amount of blood lost postoperatively was reduced significantly and not only did urinary drainage become clear in half the time, but it is estimated that the amount of blood lost during the period of bleeding was materially decreased. Severe postoperative hemorrhage occurred only once in the entire series of patients treated with Thrombin (Topical) and manifested itself twenty-four hours postoperatively and required fulguration of bleeding areas. On the other hand, bleeding occurred five times in the control series. In one patient, irrigation was begun twelve hours postoperatively, not because of any alarming hemorrhage, but because it was believed that Thrombin (Topical) had not sufficiently controlled the oozing. This case illustrated well that by the use of Thrombin (Topical) one has much to gain and nothing to lose, for irrigations can always be instituted if deemed advisable.

Complications, not related to bleeding, were not altered in their incidence or character and no reactions attributable to the Thrombin (Topical) were encountered.

COMMENTS

Our results with the use of Thrombin (Topical) following prostatic resection, have been most gratifying, so much so that we have adopted its use as a regular procedure. The most striking advantages are simplification of the postoperative management and greater comfort and smoother convalescence of the patient. Our enthusiasm has not, however, overridden our realization of its limitations. We must emphasize that rigid adherence to previous standards of resection technics should not change despite the use of Thrombin (Topical) or any other hemostatic agent. Transurethral surgery of the prostate remains an exacting, highly technical procedure and Thrombin (Topical) as an hemostatic agent must not be used as a substitute for good surgery.

SUMMARY AND CONCLUSIONS

1. Thrombin (Topical) has been employed as an hemostatic agent following transurethral resection of the prostate in more than fifty cases, and results compared with an equal number of cases in which this preparation was not used.

2. Results with the use of Thrombin (Topical) were very satisfactory: (a) Postoperative bladder irrigations were completely eliminated, reducing the amount of work necessary. (b) Postoperative bleeding was decreased in amount and duration. (c) The inlying catheter could be removed earlier, and there were fewer postoperative hemorrhages when Thrombin (Topical) was employed than when irrigations were relied upon in the postresection period. (d) The use of 10,000 units was found to be more efficacious than the 5,000 unit preparation. (e) There were no toxic effects nor other disadvantages in the use of Thrombin (Topical).

3. It must be emphasized that Thrombin (Topical) as a hemostatic agent cannot be used as a substitute for careful hemostasis in the technic of transurethral resection of the prostate.

REFERENCES

1. O'Conor, V. J. Thrombin (Topical), as a hemostatic aid in prostatic surgery. *J. Urol.*, 53: 584, 1945.
2. Palomo, A. Evaluation of Thrombin following transurethral prostatic resection. *J. Urol.*, 53: 590, 1945.

URINARY STRESS INCONTINENCE IN THE FEMALE*

A COMBINED GYNO-UROLOGICAL APPROACH TO ITS CORRECTION

WALTER J. REICH, M.D.,
Attending Gynecologist and Director, Gynecological Division of the Fautus Clinics, Cook County Hospital

J. LESTER WILKEY, M.D.
Associate Attending Urologist, Cook County and Grant Hospitals

AND

HAROLD E. SILVERMAN, M.D.
Adjunct Gynecologist, Mt. Sinai Hospital; On Visiting Staffs, Edgewater and Grant Hospitals

CHICAGO, ILLINOIS

THE average recurrence of 20 per cent of the cases of incontinence subsequent to attempts at its surgical correction is in itself evidence that the answer to this distressing problem is as yet wanting. We are consequently of the opinion that a more carefully combined gynecological and urological study of the causative factor, after the exclusion of systemic disturbances, plus a meticulous anatomic restoration of the damaged tissues is of paramount importance. Additional detailed scrutiny into the preoperative, and immediate and late postoperative care will also insure a greater percentage of alleviations of this very troublesome condition.

When the patient presents herself, a careful consideration of her history will usually establish or rule out such extra-gynecological etiologies as orthopedic, neurological, hematologic, or those with a traumatic background. Further, a detailed history may occasionally provide an answer to the elimination of some of the poor results heretofore obtained in the treatment of the condition by making us appreciative of various combinations. The fact that a woman has sustained a traumatic delivery, or has had multiple pregnancies often side tracks the physician and renders him non-cognizant of concomitant systemic residues which could easily provide the answer to the entire situation.

The history is followed by a complete physical examination to determine the status of all systems, followed by confirmatory laboratory procedures. The latter include a complete blood count, (noting especially the color index), complete urinalysis, Wassermann, and an *x*-ray film of the lower spine. The roentgenogram may of occasion reveal an often unsuspected occult spina bifida, which is a very frequently overlooked cause of urinary incontinence.

After concluding from the history, physical examination, and laboratory findings that the urinary stress leakage is not due to extraneous causes, we then, and only then proceed with a gyno-urological study to determine the extra- and intracystic and extra- and intraurethral status. Cystourethroscopy has been very advantageous and has provided the answer to many of our incontinence problems. By this type of endoscopic study we have quite frequently discovered etiologies for incontinence which were not due to pure anatomic changes, and which, therefore, could not have been corrected by attempted surgical repair.

Some of the occasionally overlooked "non-operative" causes of incontinence, we have found, are chronic follicular

* From the Departments of Gynecology and Urology of the Cook County and Grant Hospitals and the Cook County Graduate School of Medicine.

urethritis and trigonitis, paradoxical incontinence, bladder diverticulas with a concomitant low grade inflammatory process, urethral diverticulas, and suburethral cysts. Nor must one omit a ball-valve polyp of the vesical neck which prolapses into the urethra, or a ball-valve stone. Stricures of the urethra also produce a psuedo-incontinence by retaining urine behind them; upon complete urethral relaxation after micturition, the retained urine drips out when the woman assumes the erect position.

The usual etiology of the so-called "true operative cases" is childbearing, but other causes must be considered. These are coitus against congenitally weak tissues, trauma, and continued friction such as seen in women who have ridden horses or bicycles over a long period of time, and chronic masturbators of the intravaginal type.

URETHROCYSTOSCOPIC FINDINGS

In the above "true surgical cases," the endoscopic findings are definite. There is a loss of normal contour of the vesical neck and of the urethra. Definite sagging or flattening of the posterior commissure of the neck is found, and to such a level as to make the trigone on an even level with the floor of the urethra. In other words, the normal angle between the internal orifice of the urethra and the floor of the bladder is altered. This being so, the involuntary sphincter at the vesical neck, or Bells muscle, is rendered physiologically incapable, and at no time, therefore, is the bladder neck completely closed. There is also a definite sagging of the floor of the urethra, especially in its upper two-thirds. When a urethrocele is present, a pocket, or what appears to be a diverticulous opening in the floor of the urethra and bladder neck is seen.

The trigone is shortened postero-anteriorly, and consequently the interureteric ridge is closer than is normal to the vesical neck. The ureteral orifices are therefore also closer to the neck of the bladder.

In the normal female, the long axis of the urethra is at right angles to the floor of the bladder. In the "true operative cases" the angle is decreased, and in the severe cases there is no angle whatsoever present.

As a routine during the endoscopic examination, the patient is told to urinate with the cystoscope in place. In a normal female, the posterior commissure is elevated from 2 to 2.5 cm. during this procedure, whereas in the truly incontinent patients there is no more than ½ cm. elevation, and in the severe cases there is no elevation noted. In all of this work the McCarthy Foroblique cystoscope is employed.

ANATOMICO-CLINICAL CONSIDERATIONS

GENERAL FEATURES

During the process of fetal development, the anterior portion of the urogenital section of the cloaca is designated as the allantoic space. It is the upper division of the space which becomes expanded, and eventually gives rise to the summit of the urinary bladder, while the caudal end forms the corpus and fundus vesicae. The urethral tube is, in turn, derived from the lowermost portion of this same space. Both of these viscera ultimately garner their supporting elements from the differentiated and undifferentiated mesenchyme which is located at or near their point of origin. They are secondarily supported by certain other viscera which spring from entirely different anlage than themselves, but because these organs are environmental, they serve as organs of attachment.

The bladder is situated in the midline of the anterior pelvic hemisphere and is firmly imbedded in the pelvic floor. Its base and inferior surface are in contact with the posterior aspect of the pubis, the levator ani and their overlying fascia, and between the medial margins of the latter, with the upper surface of the urogenital diaphragm. Its strong attachment to the pelvic floor and urogenital diaphragm is gained through the medium of the strong

tendinous arches of the pelvic fascia, and the pubovesical ligaments. This fixed portion forms part of the vesical platform. The rest of the bladder is separated from the pelvic walls and floor by fatty and areolar tissue. The cervix uteri and upper part of the vagina help support the base of the bladder by virtue of the fact that the bladder is loosely attached to them; by their attachment to the pelvic walls, they further act as an aid in indirectly suspending this viscus. If they fall, the vesical fundus must also, of necessity, descend.

The urethra, the canal of exit, or excretory duct of the bladder, is a tube which varies from 2.5 cm. to 4 cm. in length. It is curved slightly upward with its concavity forward. It is firmly attached to the anterior vaginal wall, and therefore describes the same angle as the vagina, which is about 45 to 55 degrees with the horizontal, and is therefore approximately parallel with the plane of the pelvic brim. When nor distended, the urethral mucous membrane is more or less corrugated throughout its length due to the sphincteric action of its surrounding muscle fibers and fascia. Further, it is firmly attached to the pubic arch by the strong medial pubovesical ligament. The uppermost portion of the canal is imbedded in the pelvic floor in connection with its mother vicus, the bladder. It enters at once into the urogenital diaphragm between the layers of which it is surrounded by the fibers of the sphincter urethrae muscle. It is also, together with the vagina, influenced at its lower end by the so-called sphincter vaginae, or bulbocavernosus muscle.

PERTINENT FEATURES

Intrinsic Bladder Musculature. The muscularis of the bladder consists of unstriped fibers arranged in three layers, namely, an external longitudinal, a middle circular, and an internal longitudinal coat. The middle circular layer is of utmost importance due to the fact that its fibers converge toward the urethro-vesical junction, the so-called vesical neck, and surround it in collar-like fashion, thereby creating a strong involuntary muscular ring which is known as the internal urethral sphincter. This ring is the most internally situated of a series of sphincters which is encountered along the length of the urethra from the vesical neck toward the external meatus.

The internal urethral sphincter, then, plays a very important rôle in the continence of urine, and it is this muscular ring which is isolated and plicated in the Kelly plastic procedure for the correction of urinary stress incontinence. However, since it is only one of the several sphincter factors in the control of urinary flow, its repair alone is definitely not sufficient in the correction of impaired urinary control.

Intrinsic Musculature of the Urethra. The muscular coat of the urethra is composed of two layers of smooth fibres, an inner longitudinal and an outer circular.

This coat might be said to possess a centrifugal action in that it contracts with equal force from all points on the periphery toward the center of the urethral lumen. The tendency toward marked reduction of the lumen calibre is at once apparent.

It is reasonable to assume that the forces which create urinary incontinence must necessarily include the urethral musculature and produce some anatomico-physiological disturbances in it. However, it is not feasible to attempt to repair these fibers during surgery for incontinence.

The Pubocervical Tissues. The viscera are set in the midline of the pelvis, leaving a good deal of space between them and the pelvic walls. The spaces between the peritoneum above, the pelvic walls laterally, the viscera medially, and the pelvic floor inferiorly are all filled with connective tissue. It is this tissue which is developmentally derived from the undifferentiated mesenchyme of the embryo, and by its local condensations also provides fascial coverings for the viscera, sheaths for their ducts, coats for the nerves and vessels, the so-called neurovascular bundles, and

epimysial lamellae on the pelvic face of the muscles.

Around the visceral canals the pelvic connective tissue becomes condensed and fuses with the pelvic fascia where it is reflected on to the walls of the urethra, bladder, and vagina to form more or less strong sheaths for these structures. The neurovascular bundles spread out and fuse with these sheaths just as their nerves and vessels reach the organs they supply. Thus we find that the aforementioned viscera are all firmly fixed to the pelvic floor by a fusion of three different sets of tissue: the pelvic fascia, the pelvic connective tissue *per se*, and the sheaths of the neurovascular bundles.

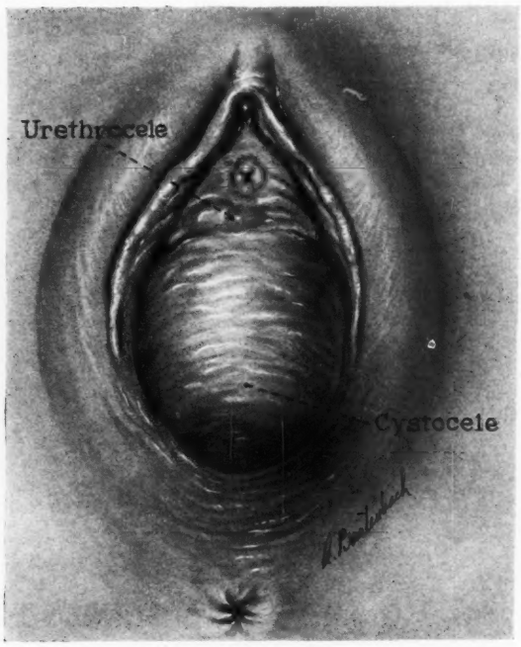


FIG. 1. Frontal view of cystocele and urethrocele.

A structure frequently referred to in the gynecologic literature is the so-called uteropubic fascia or pubocervical muscle. This is in reality a name applied to the loose and condensed connective tissue which is associated with the angle between the base of the bladder, the urogenital diaphragm, and the medial margin of the levator ani on either side of the midline, uniting the bladder to these structures, and the structures to one another. It is, then, a very definite entity which extends from the pubes to the upper part of the vagina, where it fuses with the connective tissue of that area and also with that of the para cervical region. Through these connections along the lateral borders of the cervix and vagina, the pubocervical tissues link up with the neurovascular bundles of the parametrium. Thus they receive an accessory indirect attachment to the pelvic walls by way of this medium.

The downward prolongations of the pubocervical tissue also find their way between the bladder base and anterior vaginal wall. In this location, it should be referred to as the vesicovaginal fascia, but is more frequently spoken of as pubocervical or perivaginal. Here it is of a loose areolar type, which means that only a frail connection exists between bladder muscularis and the musculature of the vaginal wall. A line of cleavage is therefore easily found and followed in the process of separating the anterior vaginal wall from the bladder base during cystocele repair, and when the dissection is at an end, the pubocervical tissue will be found on the presenting surface of the vesical fundus. By properly plicating the tissue, a portion of the platform upon which the bladder rests is made taut, and the fundus vesicae therefore elevated on its transverse and longitudinal axes.

Marked reduction in the size of a cystocele, or even its entire disappearance may be accomplished by this procedure. By doing away with the abnormal pouch of bladder, the drag is taken away from the posterior urethral wall, especially in the regions of the internal voluntary and involuntary sphincters. That this is a great aid in restoring urinary continence, goes without saying.

In direct contrast to the situation which prevails between bladder and vaginal wall is that which occurs between the posterior urethral wall and anterior vagina. Here the urethral tube is exceedingly firmly adherent and imbedded. Most of the

anatomical and gynecological texts make mention of a urethrovaginal septum. However, the admirable work of Goff has

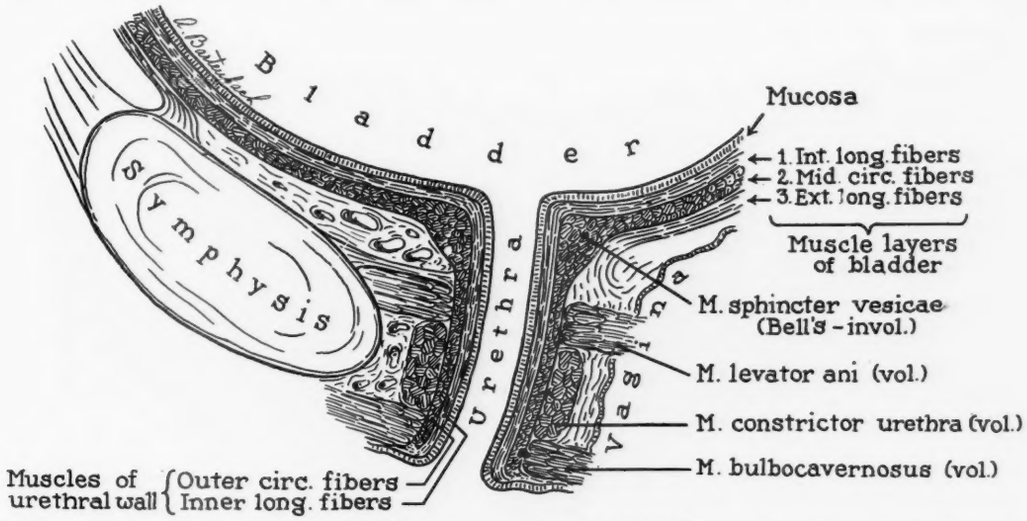


Fig. 2. Diagrammatic analysis of inherent musculature of bladder and urethra, and extrinsic muscular sphincter apparatus.

demonstrated that no fascia or areolar tissue exists between the posterior urethral and anterior vaginal walls, and that muscularis of the urethra and the muscular coat of the vagina are in firm contact with one another. This means that no plane of cleavage exists between the two organs, and is an exceedingly important point to bear in mind during surgery of the region. In the course of exposing the urethra, comparative difficulty will usually be encountered. However, if one remembers that in order to expose this organ, its muscular coat must be directly separated from the muscularis of the anterior vaginal wall, serious injury to it may be avoided.

The Tendinous Arches and Pubovesical Ligaments. Much confusion exists in regard to the tendinous arches, or as they are also known, the Arci Tendinei or White Lines. Perhaps this is so because most textbooks do not make clear the fact that the pelvis possesses four arches, two on either side.

On the obturator internus fascia a white thickening occurs near the level of the obturator foramen. This "white line" courses forward and medially, describing a slight arch, from the ischial spine posteriorly to the lower border of the pubis anteriorly. From it arise some of the fibers of the levator ani, and, it is therefore known as the tendinous arch of the levator ani muscle. It is not, *per se*, an important factor in pelvic visceral support.

Upon the fascia which covers the superior or pelvic surface of the levator ani, a second white thickening is apparent. It, like the previously described arch, courses from the ischial spine to the pubis, diverging from the white line of the levator as it approaches the pubis, and inserting lower down on the pubis than the latter. It lies at a lower level than the levator arch, and is therefore sometimes referred to as "the lower tendinous arch." Because of the fact that the fascia endopelvina takes origin from it, this structure is also known as the "white line of the pelvic fascia" or the "tendinous arch of the pelvic fascia."

As they approach the pubes the lower arches lend strong support to the sides of the bladder base, and near its insertion into the pubis, the arch on each side gives off two strong projecting limbs. The most lateral of these also lends great aid in bladder fundus support, and is known as the lateral pubovesical ligament, or "lateral true ligament of the bladder." The medial limb dips downward even more medially

to fuse with its fellow of the opposite side to form the medial pubovesical ligament, or so-called "medial true ligament of the

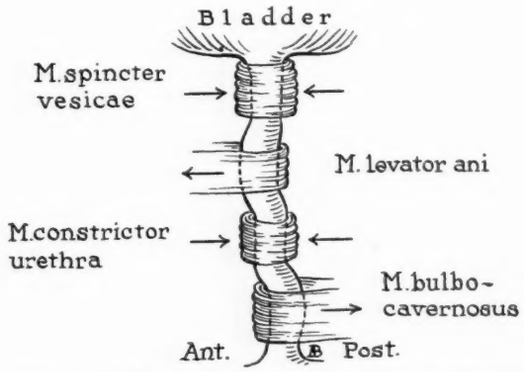


FIG. 3. Diagrammatic analysis of urethral sphincter mechanism. The circumferential compressing effect of sphincter vesicae and constrictor urethrae muscle is shown. Angulation of urethra in opposite directions by levator ani fibers and bulbocavernosus muscle is also illustrated.

bladder." It is this prolongation or branch of the lower tendinous arch which so admirably helps to support the anterior aspect of the bladder base, and which so firmly slings the urethra to the pubic arch.

Needless to say, it is not feasible to utilize the tendinous arches of the pelvic fascia directly, or the medial and lateral pubovesical ligaments in the surgical correction of cysto-urethrocele. However, if one takes cognizance of the fact that these structures take origin from the superior fascia of the pelvic diaphragm, and are therefore intimately connected with that diaphragm, he must at once realize that by taking up the slack in the pelvic floor by means of a posterior colpoperineorrhaphy, he indirectly restores the resiliency of the tendinous arches and pubovesical ligaments. This of course helps to create a strong urethrovesical platform, and to more strongly anchor the urethra to the pubic arch.

The Pelvic Floor. The pelvic floor is embryologically derived from the sacral myotomes, and since it represents the flexors and abductors of the tail, it plays a rôle in the human which is phylogenetically unsuited to it. The floor *per se* should include the levator ani and coccygeus muscles and the strong fascia on their upper or pelvic surface, together with a thinner fascia on their inferior or perineal aspect. Since the viscera under consideration in this communication are situated in the anterior portion of the pelvic cavity, we concern ourselves only with the anterior division of the floor, the musculature of which is made up by the levator.

The division of the levator ani muscle which is associated with the genital hiatus is broad and bandlike. It includes the pubococcygeus and pubrectales, which in dissection, are practically indistinguishable from one another. These fibers form a strong bifurcated sling which extends from the pubis in front to the coccyx behind. From the perineal body to the pubes, its two limbs bound the genital hiatus and are in direct relation with the vagina, the base of the bladder and the beginning of the urethra. They are also related to the upper surface of the urogenital diaphragm and are strongly supported by it. By contraction of this musculature, the pelvic floor is raised as a whole, the anal canal is drawn upward toward the pubes, a strong sphincteric action on the vagina manifests itself, and the bed or platform upon which the bladder and the first part of the urethra rest are elevated. Further, it should be remembered that no matter by what means the viscera are suspended, this floor forms the ultimate foundation upon which they lie. It is therefore the only true support, while the other structures, which in ordinary parlance are referred to as supports, are in reality suspensories.

A portion of the levator ani muscle not ordinarily described in textbooks is that small but very important segment which is attached to the urethra to form a strong voluntary sphincter. It is located just anterior to the involuntary internal urethral sphincter; it is U-shaped, and by its contraction brings the posterior urethral wall up against its anterior wall, thereby

angulating it and creating a strong sphincteric effect.

According to Hinman, a successive series of voluntary loops are sometimes thrown about the entire length of the urethra by the levator, and these act as multiple sphincters. However, they are evidently not constant, as dissections and histological studies do not always disclose them.

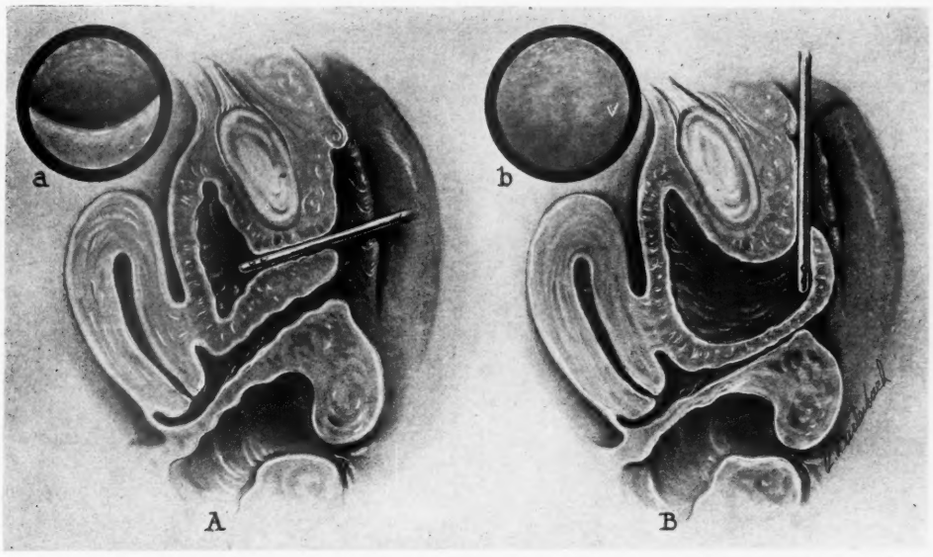


FIG. 4. A, normal bladder and urethra. Catheter describes a 45 to 50 degree angle with the horizontal upon insertion. a, cystoscopic view obtained in normal urethrovesical anatomical status and relationship. B, cystocele and urethrocele, illustrating the anatomical departure from the normal. Inserted catheter assumes a 90 degree angle with the horizontal. b, cystoscopic view obtained in cysto-urethrocele.

Because of the anatomical facts above described, a properly executed operation for the cure of urinary incontinence should include the plication of the peri-urethral levator fibers in order to angulate or tighten the tube postero-anteriorly. Furthermore, a subvaginal approximation of the attenuated pubococcyge and their overlying fascia at the same sitting serves to take up the slack in the pelvic floor, thereby raising and strengthening the foundation which supports the vesical fundus and first part of the urethra. In addition, since the urethral levator sphincter is derived from the pubococcygei, a well executed perineorrhaphy must of necessity further tighten this sphincter, and therefore greatly aid in abolishing the condition of incontinence.

The Urogenital Diaphragm. In the female, the urogenital diaphragm or triangular ligament is a strong, dense, fibrous and muscular structure. It extends from a point immediately behind and below the arcuate ligament of the pubes to the anterior margin of the ischial tuberosity on either side, and has a strong attachment to the inner aspect of the ischiopubic rami. Medially, it is continuous with the walls of the urethra and vagina, and it is continued directly into the perineal body posteriorly. By this means these three structures indirectly gain firm attachment to the bones. In addition, the vesical base is well supported by it.

This entity, then, forms a strong support for the anterior part of the pelvic floor from the pubes to the perineal body. This corresponds to that space which is left by the divergence of the levator bellies as they pass backward from the pubes, the so-called genital hiatus. It is thus a means of strengthening and supporting the floor of the pelvis at this point of weakness.

In structure the diaphragm consists of three layers, namely, a sheet of fascia on either surface with a layer of muscle

between. The superficial or inferior fascia is strong and fibrous. It is regarded as being in the same morphological plane as the bony and ligamentous pelvic wall, that is, as a part of that wall developmentally. The deep or superior fascia is in reality merely a portion of the obturator division of the parietal pelvic fascia prolonged and reflected antero-inferiorly.

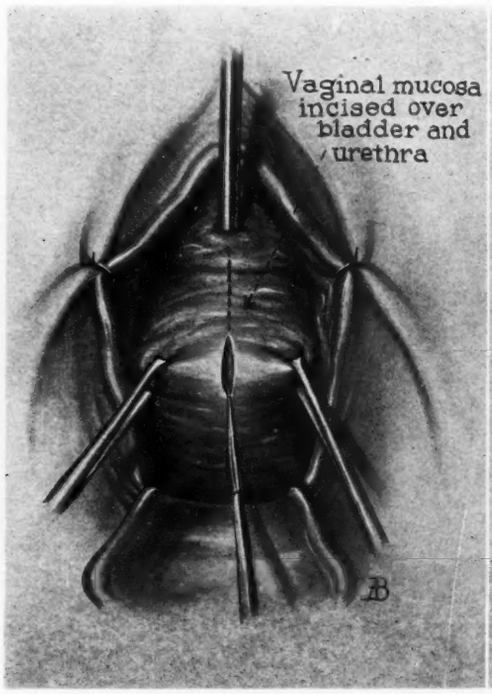


Fig. 5. Initial incision over crest of cystocele with catheter *in situ*. Incision is extended upward to urethral meatus, and downward to the cervix.

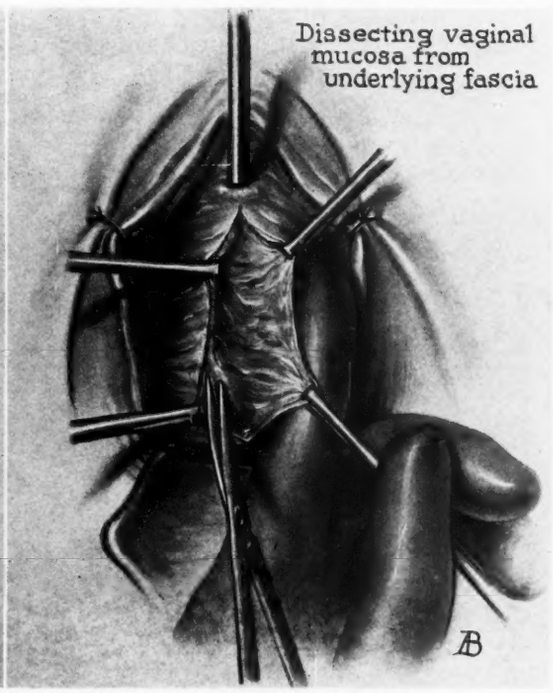


Fig. 6. Separation of anterior vaginal wall from bladder. Sharp scissors dissection removes pubocervical tissue from vaginal wall and allows it to remain on presenting surface of vesical fundus.

The muscles in the diaphragm are the deep transverse perineal, and the sphincter urethrae, both derived embryologically from the cloacal sphincter. The former stretches across the pelvis between the two ischial tuberosities, while the fibers of the latter course upward and inward to surround a segment of the urethra just anterior to the levator sphincter. Since the sphincter urethrae muscle surrounds the entire periphery of this portion of the urethral tube, the voluntary contraction of its fibers must necessarily narrow its lumen in a circumferential manner.

The properly performed operation for urinary incontinence, therefore, must include the plication of the peri-urethral fibers of the sphincter urethrae muscle. Further, during routine repair of the lacerated perineum, the posterior border of the urogenital diaphragm should be identified if possible, and made taut by reefing or plication. This maneuver will aid in no small measure in the restoration of urinary continence, in the firmer anchorage of the urethra, as well as in the reinforcement of the genital hiatus.

The Bulbocavernosus Muscle. The bulbocavernosus muscle, or sphincter vaginae consists of two halves which are placed one on either side of the vestibule. It is of the voluntary variety and is situated in the superficial perineal compartment, covered by Colles fascia, and resting on the inferior fascia of the urogenital diaphragm. Posteriorly the fibers of each side meet in the perineal body and are attached to the central tendon of the perineum. Anteriorly, the two portions of the muscle become narrower, and, converging toward the

midline, are attached to the sides of the clitoris, and arch over the anterior urethral wall in the manner of an inverted "U."

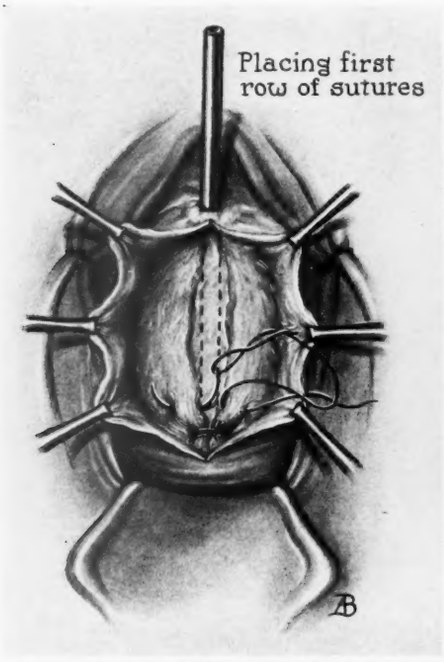


FIG. 7. Plication of pubocervical tissue plane with catheter still *in situ*. Number of rows of sutures placed depends upon amount of relaxation present.

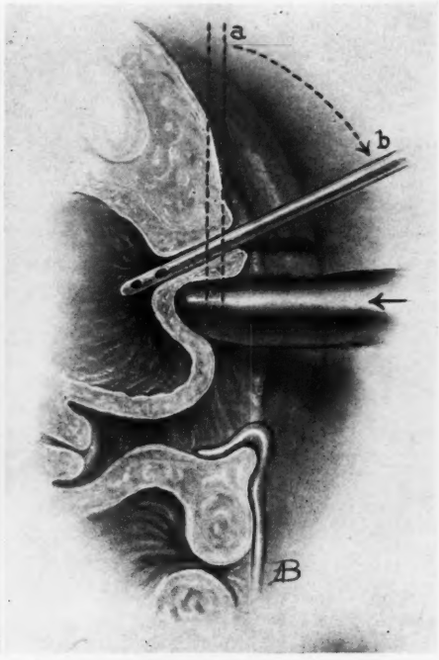


FIG. 8.—Manipulation of catheter from within vagina to produce a normal urethral angle.

The latter situation allows for the compression of the anterior wall of the urethra against its posterior wall during contraction of the muscle, in direct opposition to the action caused by the contraction of the levator sphincter at the vesical end of the urethra.

When operating for the cure of incontinence, a proper anatomical repair should include the suturing of the stretched or lacerated bulbocavernosus fibers which are found peri-urethrally. In addition, the retracted posterior ends of the muscle should be sought after and restored by suture during performance of the perineorrhaphy.

MODUS OPERANDI OF LABOR IN THE PRODUCTION OF INCONTINENCE

The cervix being fully dilated, the passenger must pass down through the vagina, slowly dilating it and the surrounding structures. The cervix does not change its level anteriorly or posteriorly. The external os, though fully dilated, retains its general relations to the plane from the symphysis to the coccyx, expanding to the diameter of the pelvis, but neither ascending or descending as far as its bony relationships are concerned.

The bladder rises above the symphysis, but only in its flattened and stretched upper part. This organ is long and narrow and the position of those parts attached to urogenital diaphragm are not altered. The urethra retains its position as does the lower portion of the vagina. The lower part of its pubic segment cannot move, for it is firmly anchored by the urogenital diaphragm to the ischiopubic rami. The loose bladder may be pulled or squeezed up, but the parts supporting the base of the bladder and first portion of the urethra remain to be stretched, contused, or lacerated by the descending head. The urethrovesical platform is thus broken down, and the urethral sphincters are stretched and distorted, while, at the same time, their normal angle is greatly altered.

If the fetus comes through slowly and gently, the muscular and fibrous tissues, softened by the processes of pregnancy and labor, gradually dilate and allow it to pass. However, if undue force is employed either by the powers or by the obstetrician, these supports are weakened to a greater or less degree. Further, the question of the duration of the particular labor, the existence of any cephalopelvic disproportion with its usual attendant compression of nerves and vessels (leading to trophic and nutritional disturbances of the supporting elements), must necessarily be a prime factor in the future anatomicophysiological status of the viscera under consideration.

It is unfortunate that almost every labor, regardless of how scientifically conducted, produces greater or lesser amount of injury to the pelvic supporting structures. To what degree restitution to normal will occur, depends of course upon the degree of damage produced, plus the great factor of tissue restorative abilities of the individual patient. With very few exceptions, it may safely be stated that no pelvis remains normal after it has once been subjected to the inevitable injury produced by the downward passage of a full term fetus. Repeated labors aggravate the original damage.

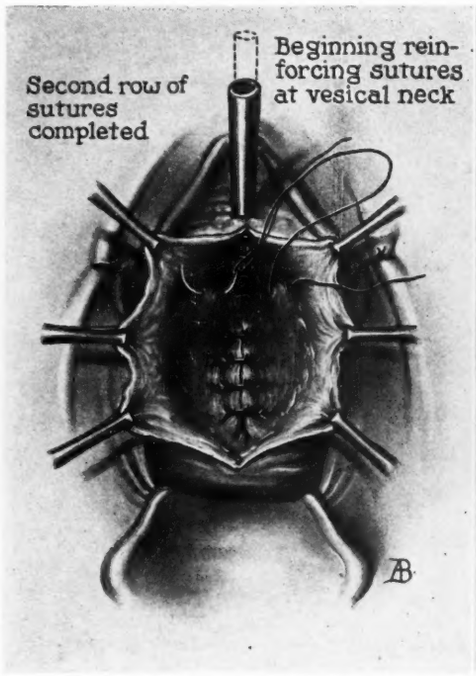


Fig. 9. Beginning reinforcing sutures at vesical neck. Subsequent sutures are placed along the entire length of the urethra up to the external meatus.

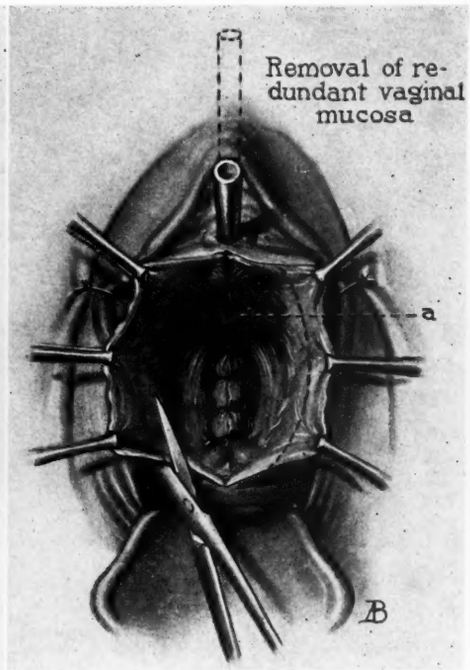


Fig. 10. Peri-urethral sutures shown in place (a), and catheter assuming a normal angle with the horizontal. The redundant vaginal mucosa is excised.

Since the bladder and urethra are subject to direct compression during labor, and their supports, nerves, vessels, and sphincter mechanisms injured, it is little wonder that so many women suffer the condition of urinary stress incontinence subsequent to childbirth. That surgery for this condition is necessary, goes without saying.

PREOPERATIVE MANAGEMENT

In addition to the usual régime employed preparatory to all vaginal operative procedures, we lay particular stress upon the condition of the urine and bladder. Since most of the patients with "true operative incontinence" have an associated low grade bladder infection, and many of them have experienced repeated attacks

of acute cystititis, we routinely culture the urine.

Mandelic acid, the sulfonamides, and in alkaline infections, irrigations of the bladder with sterile citric acid titrated to a hydrogen ion concentration of 4 are employed in the case of lower tract involvement. If a virulent organism is found on culture, the upper urinary tract is investigated, and penicillin used if a Gram-negative bacillus is not the offending organism. We never attempt a surgical repair unless the urine is definitely clean.

SURGICAL TECHNIC

A light weighted piece of metal tubing or plastic rod with a No. 16 F. size may be placed in the bladder. We suggest the use of a light weighted metal catheter of this calibre. It will be noted that in the "true operative cases," the vast majority of which have a combined urethrocele and cystocele, this tubing will approximate an angle of 90 degrees with the horizontal upon insertion.

Next, a longitudinal incision is made in the anterior vaginal wall extending from the external urinary meatus to the cervix. The subsequent separation is facilitated by beginning the incision at the crest of the cystocele when the latter is present, and then extending the incision superiorly to the external urethral opening and inferiorly to the cervix.

In those infrequent cases in which the urethrocele is unaccompanied by a cystocele, it is still much more advantageous to start the initial incision over the bladder for two reasons: first, because no cleavage plane exists between the anterior vaginal wall and the urethra, while a plane is present between the anterior wall and bladder; and secondly, we are of the opinion that mobilization of the bladder with subsequent advancement and plication of of the pubocervical tissue plane helps to rebuild the damaged urethrovesical platform, irrespective of the presence of a clinical cystocele.

After the vaginal incision has been made, sharp scissor dissection is used in the mobilization of the bladder, being certain to leave as much of the pubocervical tissue as possible attached to the wall of the vesical fundus, and keeping the vaginal wall devoid of it, as the excess of the latter will subsequently be discarded. Further, this maneuver acts as a prophylactic measure in protecting the bladder wall from injury during the suturing which is to follow.

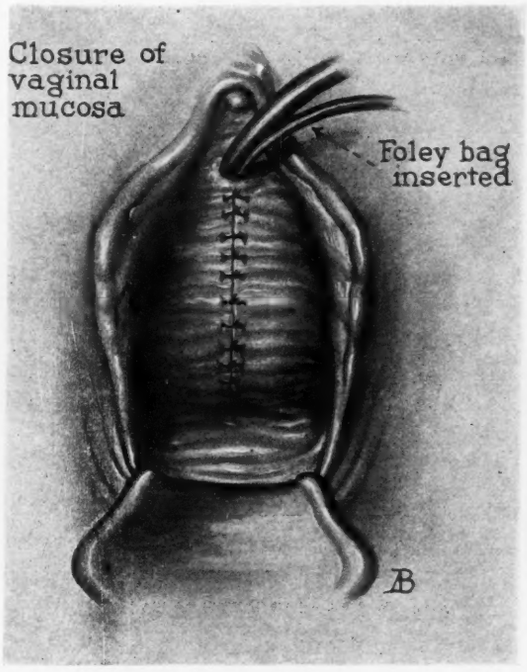


Fig. 11. Completed operation with anterior vaginal wall sutured. Metal catheter is removed and Foley bag inserted into bladder.

After complete mobilization of the bladder and urethra, the flexor surface of the index finger is placed against the catheter from within the vagina and the catheter gently stroked from above downward. The initial point at which the catheter is found to assume an angle of 45 degrees with the horizontal is designated as the urethrovesical junction. It is at this point that we are desirous of building up an integral portion of the platform which will enable the catheter to maintain this angle permanently.

The pubocervical tissue is next plicated in the midline, beginning near the cervix and extending upward to the urethrovesical

junction, employing interrupted fine silk sutures. We are careful not to stray from the midline, and to place our sutures only through the pubocervical tissue, avoiding the actual bladder wall. By making this axiomatic, we minimize the possibility of fistula production plus the inclusion of the juxtavesical portion of the ureters in our sutures. Further, by employing this technic, the repair involves only the trigone as to elevation, and does not distort its anatomy, especially as to boundaries. In fact, the normal distance from the interureteric ridge to the vesical neck is restored, the ureteral orifices are brought back to their normal relationships with the urethra, the distorting influence of the cystocele bulge on the posterior wall of the urethra is eradicated, and the urethral sphincters are once again made to assume a normal angle. A new urethrovesical platform is thus also created.

By ignoring the pubocervical tissue and placing the sutures directly into the bladder muscularis, as is indeed frequently done, the normal angle of the sphincters are restored. However, there can be no restoration of the urethrovesical platform, and the bladder trigone might be endangered. An operative shortening of the distance from the interureteric ridge to the vesical neck would tend, on healing, to produce frequent spasms and irritation of the neck, with marked urgency and tenesmus, and possibly act as a factor in initiating a subsequent paradoxical incontinence.

The number of rows of sutures employed depends upon the size of the cystocele, but we do place at least one row even though no bladder relaxation is apparent. We then place sutures, and if we deem it necessary, reinforcing sutures at that point where the catheter is made to assume the 45 degree angle with the horizontal.

The next step is the placing of fine interrupted silk sutures from the external meatus down to the vesical neck. This is accomplished with the catheter still *in situ*, and upon completion of this suturing the diameter of the urethra will approximate 16 F., with a restoration of its normal circular contour. By this maneuver the urethral sphincter fibers of the bulbocavernosus, the sphincter urethrae muscle which lies within the layers of the urogenital diaphragm, the urethral sphincter fibers of the levator ani, and the involuntary internal urethral sphincter are successively plicated and shortened. In addition, the urethra, which during micturition normally should approach a No. 14 F. calibre, is approximated to a No. 16 F. calibre so that a No. 2 F. compensation exists for the contraction of scar tissue subsequent to the repair.

The redundancy of anterior-vaginal wall is now excised, and the residual portion brought together with fine interrupted chromic catgut, thereby creating a firmer floor for the vaginal portion of the urethra.

The catheter is then removed, and a No. 16 F. Foley bag inserted into the bladder. We prefer this bag to a mushroom catheter because there is much less trauma upon its removal, and it better protects the site of repair from injury.

The performance of a routine perineorrhaphy is the final step in the operation. By taking up the slack in the pubococcygeal bellies of the levatores and their overlying fascia, the supporting foundation upon which the bladder and urethral suspending structures rest is elevated and made taut. Indirectly, therefore, the slack is taken up in the pubocervical tissues, the tendinous arches, pubovesical ligaments, and neurovascular bundles, and as a consequence, the bladder and urethra are more firmly slung and suspended in the pelvis. Further, an indirect tightening effect manifests itself on the previously repaired urethral sphincter fibers derived from the levatores.

If also during routine execution of the perineorrhaphy the posterior retracted edges of the urogenital diaphragm and bulbocavernosus muscle can be identified, these should be reefed or plicated. This will manifest itself in an indirect tightening

effect upon the sphincter urethrae muscle, and the most external of the sphincters, that derived from the bulbocavernosus, both of which were directly shortened and tightened during a previous step in the technic.

POSTOPERATIVE MANAGEMENT

In addition to the usual postoperative treatment, daily or twice daily bladder irrigations through the Foley bag are carried out. Potassium permanganate 1:10,000 solution is employed, and in those cases in which alkaline infections were found, irrigations with sterile citric acid titrated to a hydrogen ion concentration of 4 is used. Also, mandelic acid or the sulfonamides are administered by mouth if deemed necessary. The Foley bag is left *in situ* for seven or eight days, and after its removal, the patient is allowed out of bed, and she is usually discharged on the tenth day postoperatively.

An exceedingly important point in the late postoperative care, which we never fail to include, is to impress upon the patient the need for returning about three weeks after performance of the surgery. At this time the urethra is dilated, using ordinary Hegar urethral dilaters. This is done in order to alleviate bladder spasms, and also to stretch the always overcontracted scar tissue which forms about the urethra.

SUMMARY

1. Urinary stress incontinence in women occurs frequently enough to merit our serious attention.

2. The high incidence of recurrence of the condition subsequent to attempted surgical correction indicates that the problem has heretofore not been properly attacked.

3. A plan for the diagnosis of "true operative cases" and the exclusion of "non-operative" etiologies by proper history taking, laboratory procedures, and combined gyno-urological workup is advocated.

4. The urethrocystoscopic findings in the normal female, as well as those in cases of cysto-urethrocele are described.

5. The detailed and applied anatomy of urethrovesical suspension and support is set forth.

6. A suggested new operative technic is described and the rationale for each step stated.

7. Our preoperative, as well as early and late postoperative treatment is offered.

8. Accompanying illustrations are presented for the purpose of clarifying the subject matter.

REFERENCES

1. GOFF, B. H. An histological study of the perivaginal fascia in a nullipara. *Surg., Gynec. & Obst.*, 52: 32–42, 1931.
2. HINMAN, FRANK. Textbook of Urology.
3. SPALTEHOLZ, W. Atlas of Human Anatomy.
4. PATTERSON, A. M. The mechanical supports of pelvic viscera. *J. Anat.*, vol. 41, 1907.
5. SYMINGTON, J. 1889. The normal anatomy of the female pelvic floor. *Edinburgh M. J.*, vol. 34, 1889.
6. KALISCHER. Die Urogenitalmuskulatur des Dammes mit besonderer Berucksichtigung des Harnblasenverschlusses. Berlin, 1900.
7. THOMPSON, PETER. The Myology of the Pelvic Floor. 1899.
8. KEITH, ARTHUR. Human Embryology and Morphology. 4th ed. 1921.
9. WEBSTER, J. C. Researches in Female Pelvic Anatomy. 1892.
10. SMITH, W. C. The levator ani muscle. Its structure in man and its comparative relationships. *Anat. Rec.*, 26; 175, 1923.
11. FULKERSON, L. L. Incontinence in women; urethrocele; relaxed vesical sphincter; urethral dilatation. *Urol. & Cutan. Rev.*, 43: 569–573, 1939.
12. LEWIS, E. C. Incontinence in women. *Post-Grad. M. J.*, 18: 154–157, 1942.
13. KELLY, HOWARD A. Gynecology. Pp. 821–823. 1928.
14. EISENDRATH, D. N. and ROLNICK, H. C. Urology. 4th ed., pp. 830–838. 1939.
15. FARMAN, FRANKLIN. Incontinence of urine in women. *J. Urol.*, 44: 841–846, 1940.
16. HUGGINS, C. B. Urinary incontinence; surgical physiology involved in cure of certain types. *J. Indiana M. A.*, 22: 190–192, 1929.
17. JOHNSTON, H. W. Urinary incontinence following childbirth; its surgical treatment. *Surg., Gynec. & Obst.*, 53: 97–101, 1931.

PHTHALYLSULFATHIAZOLE-'SULFATHALIDINE'

A CLINICAL EVALUATION IN 122 PATIENTS WITH PROCTOLOGIC AND RELATED CONDITIONS

GASPAR ANGELO, M.D.
Junior Surgeon in Charge of Rectal Clinic, Cambridge Hospital
CAMBRIDGE, MASSACHUSETTS

THE value of preoperative and postoperative administration of certain of the sulfonamides to patients subjected to intestinal and colonic surgery, as an adjunct to careful surgical technic, has been emphasized by numerous investigators,[1–13] and the routine use of these intestinal bacteriostatic agents has become a recognized clinical procedure. Since its introduction by Poth[1] and by Firor and Poth[2] in 1941 succinylsulfathiazole has been preferred by many surgeons because of its marked effectiveness in reducing the number of pathogenic coliform organisms in the lower intestine and colon, thus reducing the incidence of peritonitis following extensive surgical intervention or accidental soilage.

Rosser and Kerr,[3] in discussing the preoperative administration of succinylsulfathiazole, are of the opinion that, "until a more effective agent is available, no individual should be subjected to extensive surgical procedures on the intestinal tract without having had the benefit of this protective therapy." Although succinylsulfathiazole probably was the best compound at our disposal, the administration of this so-called slightly absorbable sulfonamide was attended by certain limitations, the modification or elimination of which was considered most desirable. This drug induces the formation of a semiliquid stool which presents disadvantages in the performance of certain proctologic procedures which involve the perineum, anus and rectum. Its action according to Poth and his associates[4,5] and in view of our own experience, is adversely affected by the presence of diarrhea or relatively severe constipation. Although not serious, patients often object to the relatively large dosage required. The experience accumulated since the introduction of sulfonamides during the last decade indicates that some degree of toxicity or development of sensitivity is to be anticipated on administration of any compound of this class, but the clinician anticipates also the development by his research associates of a compound which minimizes such a possibility and which, in this particular field, modifies or eliminates the somewhat unfavorable characteristics and limitations noted above.

In 1943, a new sulfonamide, phthalylsulfathiazole, was reported to possess certain properties which appeared to present more desirable characteristics and less limitations of use, in the surgical field at least, than did succinylsulfathiazole, to which it is chemically and pharmacologically related.[14–18] The clinical use of phthalylsulfathiazole in surgery has been reported by Poth and his associates,[19–21] and was mentioned by Bacon and his co-workers.[22] These studies indicated that phthalylsulfathiazole effects a more rapid reduction of Escherichia coli, vegetative forms of the clostridia and related organisms in the feces than does succinylsulfathiazole; that the feces become soft but that a diarrhea or semiliquid stool is not produced; that it is effective even in the presence of a watery diarrhea; that it is poorly absorbed from the intestinal tract; that little or no toxicity has been observed and that the dose in comparison with succinylsulfathiazole is relatively small.

During the past year an opportunity has

been presented to evaluate phthalylsulfathiazole* with respect to its use in the treatment and control of conditions commonly encountered in the practice of proctology. The description of the results obtained in patients to whom this drug was administered as included in this report is that of an unselected series, which represents 122 consecutive cases encountered in private and dispensary practice.† More than 90 per cent of these patients (112) were subjected to surgery and the remainder (10) were treated medically. The latter group is small and probably not significant in this series but is included because of certain points of interest and for completeness.

The following are the types and number of cases to which phthalylsulfathiazole was administered surgically and medically:

Phthalylsulfathiazole Administered before and after Operation	No.	
Hemorrhoidectomy (external and/or internal)	42	
Excision of fissure-in-ano (chronic and acute)	28	
Fistulectomy	18	
Resection of colon (neoplasm)	10	
Cryptectomy and papillectomy	3	
Excision of pilonidal sinus	3	
Incision and drainage of ischiorectal abscess	3	
		107
Phthalylsulfathiazole Administered after Operation		
Resection of small bowel (93 cm.) (acute mesenteric thrombosis)	1	
Laparotomy and drainage (ruptured diverticulum of sigmoid)	1	
Laparotomy and lysis of adhesions (acute diverticulitis)	1	
Appendectomy and lysis of Jackson membrane	1	
Laparotomy (exploratory) and appendectomy	1	
		5
Phthalylsulfathiazole Administered Medically		
Ulcerative colitis	7	
Infectious diarrhea (postpartum)	1	
Mucous colitis	1	
Severe pruritis ani	1	10
		122

Phthalylsulfathiazole first was administered on the basis of 0.05 Gm. per kilogram of body weight. The initial dose was followed in four hours, and each four hours thereafter, by a maintenance dose calculated on the same basis as the first dose and divided in equal parts for administration over a twenty-four hour period. In most instances the 4:00 A.M. dose was omitted and that increment added in equal parts to the 12:00 midnight and 8:00 A.M. doses. Later it was found desirable to increase the dosage to 0.1 Gm. per kilogram of body weight in order to bring about a more rapid alteration of the intestinal bacterial flora and to maintain this effect. In a short time it became apparent that the optimal dosage for our purpose was in most instances approximately 5 Gm. daily in three or four equally divided doses following an initial dose of 5 Gm.

The patients on whom anorectal surgery was contemplated received their initial dose of phthalylsulfathiazole twenty-four hours prior to operation and the medication was continued thereafter for ten days to three weeks following operation, dependent upon the extent of the surgical procedure and the progress of wound healing. The drug was administered to patients being prepared for bowel surgery for from three to five days prior to operation. As soon as these patients were able to retain an ounce of water subsequent to operation, administration of phthalylsulfathiazole was resumed as before. The drug was given also to the patients with acute conditions as soon after operation as possible.

In no instance was it necessary to interrupt the course of medication because of the appearance of toxic manifestations. In only a few instances slight anorexia and nausea were observed and in two others vomiting occurred. One of the latter, a highly neurotic patient, experienced considerable postoperative vomiting. As orders were about to be given to stop the drug, the patient volunteered the information that she "always vomited after an operation and only an intravenous injection stopped it." Physiologic saline was administered immediately and phthalylsulfathiazole was continued. The vomiting

* "Sulfathalidine" phthalylsulfathiazole was provided in generous quantities for the purpose of this investigation by the Medical-Research Division of Sharp & Dohme, Glenolden, Pa.

† Since this article was written, J. A. Bargen reports favorably on Sulfathalidine in Intestinal Disease.[24]

ceased and the patient proceeded to a normal convalescence without further difficulty. No renal complications or symptoms of any kind were observed during medication with phthalylsulfathiazole. This latter fact, together with the lack of toxic symptoms or signs in general, was anticipated in view of the poor absorption of the drug as reflected by the free and conjugated sulfonamide blood levels, determined by a modification of the method outlined by Bratton and Marshall.[23]

The free and conjugated sulfathiazole blood levels remained low, ranging between 0.2 to 3.0 mg. per 100 cc. of blood for the free and 0.7 to 3.0 mg. per 100 cc. of blood for the conjugated level. There were two cases in which the conjugated level reached 6.0 mg. The sulfonamide determinations were made at various times throughout the postoperative course of treatment. With few exceptions little difference is noted between the blood levels of patients who received 2 Gm. of phthalylsulfathiazole daily and those who received larger doses. The blood levels following administration of phthalylsulfathiazole in this series are comparable to those reported by Poth and Ross,[21] and the occasional high levels probably are due to absorption of the drug through granulating surfaces as stated by these authors.

One of the most gratifying observations noted in this series is the remarkable reduction in the number of patients to whom it was found necessary to administer purgatives preoperatively in order to clean the bowel, and enemas and purgatives postoperatively to initiate normal bowel movements. Patients subjected to anorectal surgery usually experienced a normal bowel movement on the second or third postoperative day with a minimum of effort and discomfort. It is believed that this occurred because the stool had become soft and gelatinous and most of the bulk had been lost. Because of the reduction, or in some instances, the elimination of the majority of pathogenic organisms in the feces, postoperative complications, such as abscess, anal stricture, postoperative hemorrhage and trauma due to administration of enemas, were not encountered, and, as a result, the postoperative disability was diminished considerably. Spontaneous bowel movements were observed also in patients subjected to large bowel resection and in this series one patient had a normal spontaneous bowel movement on sixth day following an end-to-end anastomosis after removal of an adenocarcinoma of the sigmoid.

In this connection it should be mentioned that primary end-to-end anastomosis can be performed, the indications for the Mikulicz operation lessened and in general more aggressive surgical intervention can be successfully executed when the patient is properly prepared with an adequate dose of phthalylsulfathiazole. In addition, the postoperative discomfort, general disability and period of convalescence are reduced to a minimum.

The administration of phthalylsulfathiazole for preoperative preparation for large bowel surgery has proved to be exceptionally advantageous. It has been observed that the administration of this drug to patients with a neoplasm in the large bowel who have definite signs and symptoms of intestinal obstruction are often relieved of distention and pain and they will frequently have a normal bowel movement. In this way acute obstruction is avoided or at least delayed until the patient is in better condition to withstand extensive surgical resection. In some way the drug seems to break up the fecal impaction which precipitates the onset of acute obstruction and the stool is changed to a soft gelatinous mass with little bulk. The drug, perhaps by reason of the free sulfathiazole produced by hydrolysis, reduces or brings under control the secondary infection in and around the neoplasm, thus reducing the edema which usually accompanies an inflammatory process. The lumen of the bowel may become widened thereby, and it may be restored to more nearly normal function. This permits better

preparation of the patient for whatever surgical procedure might be indicated.

In the ten patients subjected to large bowel surgery in this series, the results were exceptionally good. In one bleeding occurred on the fourth postoperative day and the drug was stopped. Although it is not apparent from a review of this particular group of cases, it has been our observation and that of our associates bleeding or hemorrhage from a neoplasm occurs only rarely when phthalylsulfathiazole is administered. This is in contrast to our experience with succinylsulfathiazole, since we have observed such bleeding in from 10 to 25 per cent of patients with neoplastic growths in the colon to whom this drug had been administered. Usually the bleeding is not serious with either compound and the drug may be continued, but in certain instances it becomes necessary to stop administration of the sulfonamide entirely. It may be resumed, however, as soon after operation as possible if a resection has been performed or if a colostomy is made.

In a small series of patients subjected to emergency operative procedure, five of which are reported here, the postoperative administration of phthalylsulfathiazole has appeared to be of definite advantage. Because of its rapid action in reducing the number of coliform and other gas-producing organisms, convalescence is made easier by reason of the reduction in distention with its concomitant discomfort to the patient, and the operative wound heals more rapidly. Especially favorable results were obtained in two patients with acute diverticulitis that developed severe diarrhea and cramps postoperatively. The development of a marked distention with its concomitant serious consequences was greatly relieved in another patient, on whom a resection of 93 cm. of small bowel was performed subsequent to an acute mesenteric thrombosis.

Phthalylsulfathiazole was administered to a small series of patients with ulcerative colitis and also three patients with other complaints commonly encountered in a proctologic clinic. These are included for the sake of completeness and because it appears that the drug is of some benefit in the treatment and control of ulcerative colitis. Seven cases of ulcerative colitis are here reported: five acute fulminating, one chronic ambulatory, and one intractable case with an ileostomy. The usual supportive measures generally recommended for patients with ulcerative colitis were carried out in addition to administration of the indicated dosage of phthalylsulfathiazole. Among five patients with acute fulminating ulcerative colitis* the results were excellent in three, good in one, and poor in one. The results were determined by the reduction in bowel movements, disappearance of blood from stools, and loss of toxic symptoms. All of the patients in this group were maintained on small daily doses with the thought in mind that acute exacerbations of the disease would be avoided or markedly reduced in number. All patients were observed carefully for the development of toxic reactions but none were noted. One of these patients has taken the drug daily for twelve months and has volunteered the information that he has felt better than ever before. Only an occasional and very mild exacerbation of the disease has been experienced during the time this patient has been under treatment with phthalylsulfathiazole.

In this series, also, is included a boy sixteen years of age who had an ileostomy performed at the age of twelve years, because of an extremely fulminating ulcerative colitis. During the succeeding four years frequent acute exacerbations occurred with loss of weight, constant suppurative drainage from the rectum and other serious and annoying developments for which no therapy was effective. A total colectomy was being considered at the time when daily irrigation with a suspen-

* Acute fulminating is here considered one that reveals severe systemic reactions, as fever, leukocytosis, increased sedimentation rate, purulent rectal discharge, and marked prostration.

sion of phthalylsulfathiazole through the distal loop was initiated. Within two weeks the improvement in this boy was most remarkable. His temperature became normal, suppurative drainage from the affected bowel ceased and ulcerations of the mucous membrane and the inflammatory polyps previously observed were diminished noticeably. His improvement has continued with daily administration of phthalylsulfathiazole through the distal loop during the past ten months. No toxic effects have been noted and the last sulfonamide blood level was reported as being too low to read.

Poor results were noted in mucous colitis and in pruritis ani. This is to be expected since it is generally accepted that the etiology of these conditions is not wholly of an infectious nature. The one case of acute diarrhea, postpartum, probably caused by a specific organism, certainly is not significant, but the favorable end result might indicate that an investigation of the drug as a remedy for this type of condition might prove to be of value.

SUMMARY AND CONCLUSIONS

The new sulfonamide, phthalylsulfathiazole, has been administered to a series of 122 patients with conditions commonly encountered in a proctologic clinic with the following results:

I. Dosage and Method of Administration. The average effective dose was found to be about 5 Gm. daily, administered in three or four equally divided doses following one initial dose of 5 Gm.

In anorectal surgery phthalylsulfathiazole was administered twenty-four to forty-eight hours prior to operation. In large bowel surgery it was given three to five days prior to operation.

The drug was started postoperatively as soon after operation as possible and continued for ten days to three weeks depending upon individual circumstances and the progress of healing of the wound.

II. Toxicity. The sulfonamide blood level remained quite low when 2 to 5 Gm. were administered in three or more equally divided doses daily.

Toxic reactions were negligible, only slight anorexia, nausea, and occasionally vomiting were noted.

It should be emphasized, however, that phthalylsulfathiazole is a sulfonamide drug and that toxic reactions are likely to occur if it be administered to patients who have acquired a sensitivity to this class of compounds. The administration of phthalylsulfathiazole probably should be withheld or at most the drug should be administered very cautiously to patients with a history of sulfonamide sensitivity.

III. In Ulcerative Colitis. A small series of patients with ulcerative colitis appeared to derive considerable benefit from administration of phthalylsulfathiazole in that the drug improved their general well being, reduced the number and severity of acute exacerbations and appeared to control or arrest the disease process.

IV. Reduction of Infection in Bowel Surgery. Because phthalylsulfathiazole greatly reduces the number of pathogenic coliform organisms in the lower intestine and colon, the incidence of peritonitis due to accidental soilage is greatly reduced. Thus, the primary end-to-end anastomosis can be performed without high incidence of serious complications, and that indications for the Mikulicz operation are greatly lessened.

V. Postoperative Convalescence. The use of the drug postoperatively in patients subjected to emergency intestinal surgery appears to be of definite advantage in causing a more normal convalescence.

In the preparation and postoperative care of patients in this series, the necessity for use of purgatives and/or enemas was markedly reduced. The bowel became clean and the stool became soft and gelatinous. Distention and postoperative discomfort were reduced to a minimum and spontaneous bowel movements occurred early. Healing of the wound occurred promptly and postoperative disability and complications were decreased greatly.

This study could not have been completed without the cooperation and efforts of the Laboratory Staff of the Cambridge Hospital where all determinations were done. Service cases in this study were from the Surgical Services of Drs. Horace P. Stevens, Edward Cooney, and David Rose of the Surgical Staff of the Cambridge Hospital. To these men and many others who referred private cases for this study, grateful acknowledgement is made.

REFERENCES

1. Poth, E. J. and Knotts, F. L. Succinyl sulfathiazole, a new bacteriostatic agent locally active in the gastrointestinal tract. *Proc. Soc. Exper. Biol. & Med.*, 48: 129, 1941.
2. Firor, W. M. and Poth, E. J. Intestinal antisepsis, with special reference to sulfanilylguanidine. *Ann. Surg.*, 114: 663, 1941.
3. Rosser, C. and Kerr, J. G. Recent advances in proctology. *Modern Med.*, 13: 55, 1945.
4. Poth, E. J., Knotts, F. L., Lee, J. T. and Inui, F. Bacteriostatic properties of sulfanilamide and some of its derivatives. Succinylsulfathiazole, a new chemotherapeutic agent locally active in the gastrointestinal tract. *Arch. Surg.*, 44: 187, 1942.
5. Poth, E. J. and Knotts, F. L. Clinical use of succinylsulfathiazole. *Arch. Surg.*, 44: 208, 1942.
6. Firor, W. M. Intestinal antisepsis with sulfonamides. *Ann. Surg.*, 115: 829, 1942.
7. Poth, E. J. Succinylsulfathiazole, an adjuvant in surgery of the large bowel. *J. A. M. A.*, 120: 265, 1942.
8. Zintel, H., Lockwood, J. S. and Snyder, J. Bacteriological considerations in sulfonamide prophylaxis against peritonitis. *Bull. Am. Coll. Surgeons*, 28: 51, 1943.
9. Behrend, M. Succinylsulfathiazole (sulfasixidine) and the elimination of the Mikulicz operation. *Surg. Clin. North America*, 24: 238, 1944.
10. Archer, H. L. and Lehman, E. P. Clinical and laboratory experiences with succinylsulfathiazole. *Ann. Surg.*, 119: 518, 1944.
11. Bacon, H. E., Gass, O. C. and Todhunter, W. D. The present status of the surgical treatment of cancer of the rectum and pelvic colon. *Clinics*, 3: 982, 1944.
12. Richards, V. Sulfonamides in surgery. *Surgery*, 14: 308, 1943.
13. Mackenzie, D. H. An investigation into the use of sulfasuxidine in operations on the rectum and colon. *Brit. M. J.*, 2: 722, 1944.
14. Poth, E. J. and Ross, C. A. Phthalylsulfathiazole, a new bacteriostatic agent. *Federation Proc.*, 2: 89, 1943.
15. Kirchhof, A. C., Racely, C. A., Thompson, A. I. and David, N. A. An experimental evaluation of succinylsulfathiazole phthalylsulfathiazole. *West. J. Surg.*, 51: 419, 1943.
16. Poth, E. J. and Ross, C. A. Bacteriostatic properties of sulfanilamide and some of its derivatives. Phthalylsulfathiazole, a new chemotherapeutic agent locally active in the gastroenteric tract. *Texas Rep. Biol. & Med.*, 1: 345, 1943.
17. Mattis, P. A. and Benson, W. M. Toxicological studies of phthalylsulfathiazole. *Federation Proc.*, 3: 80, 1944.
18. Mattis, P. A., Benson, W. M. and Koelle, E. S. Toxicological studies of phthalylsulfathiazole. *J. Pharmacol. & Exper. Therap.*, 81: 116, 1944.
19. Poth, E. J. The use of succinylsulfathiazole and phthalylsulfathiazole as intestinal antiseptics. *Texas State J. Med.* 39: 369, 1943.
20. Poth, E. J. The sulfonamides as therapeutic agents in intestinal antisepsis. *Internat. Abstr. Surg.*, 78: May, 1944.
21. Poth, E. J. and Ross, C. A. The clinical use of phthalylsulfathiazole. *J. Lab. & Clin. Med.*, 29: 785, 1944.
22. Bacon, H. E., Todhunter, W. D. and Gass, O. C. The preoperative and postoperative treatment of cancer of the rectum and pelvic colon. Paper read before the International College of Surgeons, Philadelphia, October 4, 1944.
23. Bratton, A. C. and Marshall, E. K., Jr. New coupling component for sulfanilamide determination. *J. Biol. Chem.*, 128: 537, 1939.
24. Bargen, J. A. Sulfathalidine in intestinal disease. *Proc. Staff Meet., Mayo Clin.*, 20: 85, 1945.

A METHOD OF TREATMENT FOR PILONIDAL SINUS*

JACOB K. BERMAN, M.D.
Associate Professor of Surgery, Indiana University Medical Center
INDIANAPOLIS, INDIANA

PILONIDAL sinus is an abnormal opening in the skin superior to the anus, in the gluteal cleft over the sacrum and coccyx. The defect is lined with epithelium and usually contains cellular débris, sebaceous material, and hair. It gets its name from two words—"pilo," meaning hair, and "nidus," meaning a nest. Either an infected foreign body or an embryonic cavity may give rise to a sinus. This lesion contains both causes.

Within the past two years a voluminous literature has accumulated on the subject of pilonidal sinus. This is due to the commonness of the lesion in the personnel of our armed forces as well as in the civilian population. Every phase of the subject has been adequately covered, and the references given may be consulted for: a historical review of the literature,[1,2] embryological factors in the causation of the anomaly,[1,2] its pathology including complications,[3] and its treatment.[4–14]

This article is a discussion of the fundamental factors concerned with the cure of the defect and a description of a satisfactory surgical method for eliminating this minor yet disabling lesion.

In evaluating the advantages of any plan of treatment two important requirements must be considered: First and foremost the percentage of cures by the method, and second, the length of time or disability required to produce the cure.

Almost all authors are agreed that recurrence and disability may reach a minimum by adhering to the following important principles: (1) complete excision of the lesion; (2) avoidance of trauma in performing this task; (3) accurate hemostasis; (4) obliteration of dead space; (5) avoidance of tension on suture lines; (6) exact approximation of wound edges, and (7) avoidance of infection in the group not already definitely the site of pus formation. These principles are those emphasized in any consideration of wound healing with a minimum of granulation tissue, and we have previously enunciated them under the caption of "factors which delay wound healing."[15]

To accomplish this end most surgeons have divided the patients into two large groups: those which are not primarily infected and those which have large burrowing infected sinuses or abscesses. The former group have been treated by the following methods: excision and primary closure; excision, sulfathiazole implantation, and primary closure; excision, undercutting, the use of fine silk as suture material, and primary closure; excision, formation of flaps, and primary closure; excision, the use of buffered sulfanilimide and primary closure; excision, packing of wound with gauze without closure; marsupialization. In the second group the treatment varies with different surgeons as follows; excision leaving wound wide open and packing with gauze of various types; excision using sclerosing solution, and leaving wound wide open; excision packing wound with sulfonamide powder and leaving the wound wide open; excision, anchoring of the wound flaps to the fascia or anchorage of the skin to the fascia of the sacrum and coccyx; cautery excision and wide open packing.

Results are as variable as the methods of treatment. MacFee[9] reported 53 per cent abscesses and other complications with

* From the Department of Surgery, Indiana University School of Medicine.

prolonged healing time in thirty-four cases of primary closure. Scott[11] reports 96.4 per cent primary healing in twenty-eight cases with an average hospital stay of 18.8 days. Woldenberg and Sharp[13] report 100 cases of excision and primary closure. Of these, ninety-eight were entirely successful; two had recurrences. Complete healing took place in fourteen days in 72 per cent. Soldiers returned to duty on the twenty-second and twenty-third postoperative days. Dunphy and Matson[10] reduced the incidence of recurrence from 27 per cent to 6 per cent by using fine silk and primary closure. In the infected group the incidence of recurrence was reduced from 22 to 4.3 per cent by using cautery excision and open packing. Buie[14] marsupializes the cyst or abscess wall and reports good results.

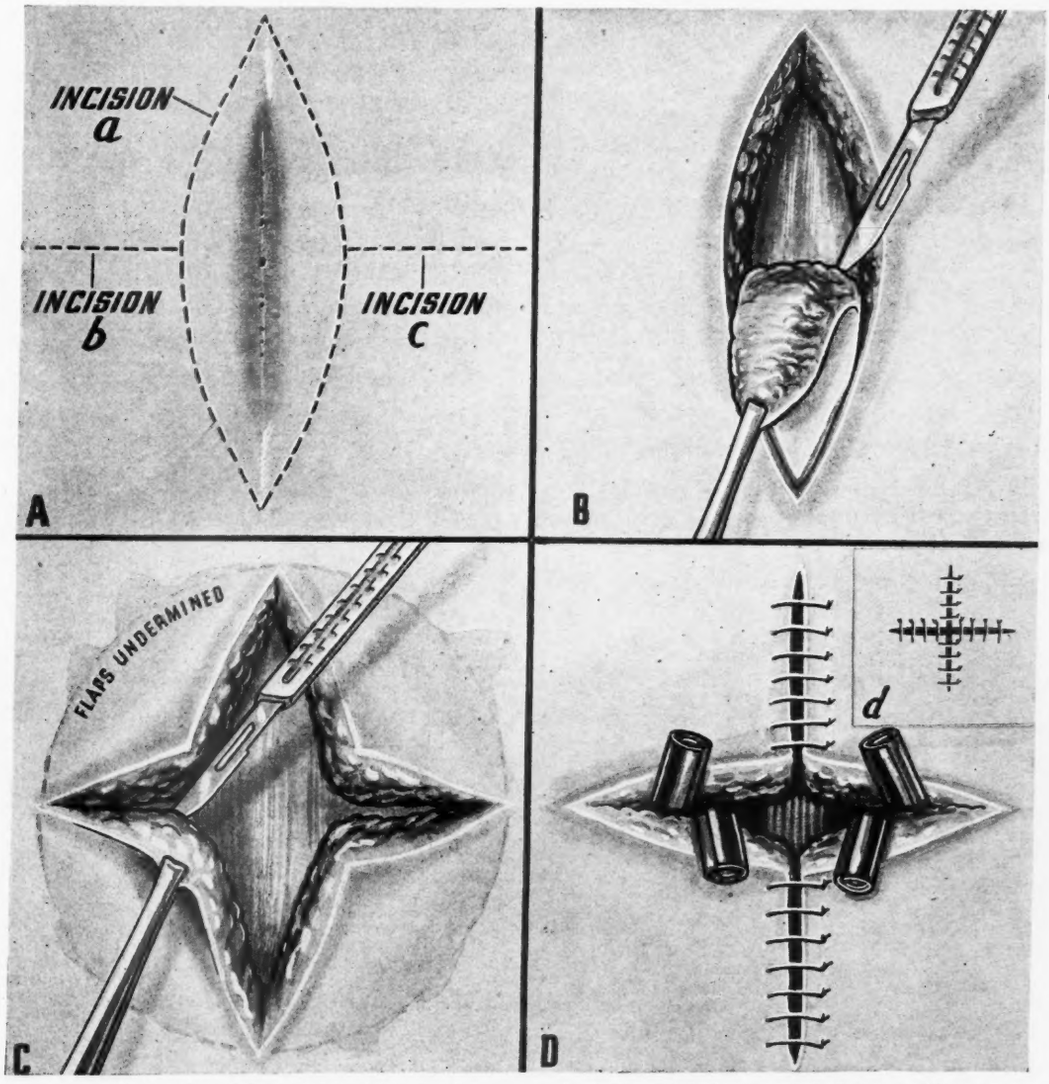


FIG. 1. A, lines of excision and incision in the removal of pilonidal sinuses and their ramifications; B, excision of the primary sinuses; C, undermining of flaps and excision of all subcutaneous channels; D, partial closure with drainage in infected cases; d, primary complete closure. The wound edges are loosely approximated so that subsequent swelling will not produce an ischemia of the suture lines.

A review of the literature impresses one with the fact that results with similar methods differ greatly among the various surgeons reporting. The concensus of opinion seems to be that the safest method to use for the prevention of recurrence is

that of wide open packing, although this necessarily carries the longest disability.

TRANSVERSE OR LATERAL INCISION WITH FORMATION OF FLAPS

Our method embodies the fundamental surgical principles necessary for wound healing by first intention. In addition it affords a short period of disability and comparative freedom from recurrence. To accomplish this in clean cases the operative field is scrubbed with soap and water for ten minutes with gauze sponges *eight days* prior to the operation. The sinus is then excised widely and completely with a minimum of trauma, under 1 per cent procaine local anesthesia. Flaps are fashioned by undercutting and by two lateral incisions as depicted in the diagram. This permits primary closure with no tension and with complete rest to the suture lines even though the patient is ambulatory. The lateral incisions are closed loosely so that drainage may take place and in infected cases they are left open although the longitudinal incisions are closed. Fine chromic catgut No. 000 has been used for the deep suture and silk or cotton for the skin. Sulfonamides have not been given by mouth or used in the wound in the infected or clean wounds.

REASONS FOR PROCEDURE

We have previously shown that in the experimental animal, scrubbing of the abdomen eight days prior to surgery increases the resistance of the abdominal wall to infection.[15,16] This we believe to be due to an increase in the local resistance of the part due to the trauma of scrubbing. The formation of flaps as described releases all tension on the longitudinal suture line. Since infection is most apt to occur in the lower portion of the incision, factors were sought which might account for this observation. It was believed that although this area was closest to the rectum and therefore the infected material, yet the constant movement of the flaps by turning in bed or walking or muscle contraction, delayed healing in this area. By permitting mobility at a higher level the two lower flaps move as a unit and the suture line is therefore put at rest.

The transverse portion of the incision is placed at a higher level so that it is less apt to be grossly contaminated. The incision provides ample drainage and allows the entire area to heal from the bottom up. Moreover it falls together better in the upright than in the recumbent position. This method combines the features of the open operation with those of primary closure and it does not have the probability for complications that primary closure has, nor does it produce the long healing period required for the open operation.

RESULTS OF TREATMENT

This procedure has been carried out in ten patients. All were males. The patients were kept in the hospital for an average of four days. The longest healing time was thirty-one days in a badly infected case and the shortest healing time was fourteen days in an uninfected case. Thus far there have been no recurrences.

CONCLUSIONS

A surgical method is described for the cure of pilonidal sinus which (1) is easily accomplished, (2) requires a minimum of hospitalization, (3) provides healing in a relatively short time, and (4) is not conducive to recurrences.

REFERENCES

1. Morton, J. Tendler. Pilonidal sinus: A review of its literature and a report of 87 cases. *South. M. J.*, 34: 1156, 1941.
2. Kosistra, Henry P. Pilonidal sinuses: review of literature and report of 350 cases. *Am. J. Surg.*, 55: 3–16, 1942.
3. Rogers, H. and Hall, M. G. Pilonidal sinus: surgical treatment and pathological structure. *Arch. Surg.*, 31: 74–766, 1935.
4. Colp, R. Treatment of pilonidal cysts and fistulas. *Surg. Clin. North America*, 9: 1929.
5. Cutler, E. C., and Zollinger, R. Sclerosing solutions in the treatment of cysts and fistulae *Am. J. Surg.*, 19: 411, 1933.

6. KLECKNER, M. S. Pilonidal sinus: *Its surgical management. Tr. Am. Proctol. Soc.*, 37: 166–173, 1936.
7. LAHEY, F. H. An operation for pilonidal sinus: *Surg., Gynec. & Obst.*, 48: 109, 1929; *ibid.*, A further suggestion for the operative treatment of pilonidal sinuses. *54*: 521, 1932.
8. PICKETT, WM. J. and BEATTY, ARCH. J. Pilonidal cysts in the army. *Am. J. Surg.*, *56*: 375, 1942.
9. MACFEE, W. F. Pilonidal cysts and sinuses: a method of wound closure. *Ann. Surg.*, 116: 687, 1942.
10. DUNPHY, J. E. and MATSON, D. D. *Surg., Gynec. & Obst.*, *75*: 1942.
11. SCOTT, JAMES V. Pilonidal cyst: the local use of buffered sulfanilimide in primary closure. *Ann. Surg.*, 117: 191, 1943.
12. BREZIN, DAVID. Pilonidal cyst: report of a new procedure for operation and treatment. *Am. J. Surg.*, *59*: 18, 1943.
13. WOLDENBERG, S. C. and SHARPE, W. S. Surgical treatment of pilonidal (dermoid) cysts. A study of 100 consecutive cases of excision and primary closure. *Surg., Gynec. & Obst.*, 746: 164, 1943.
14. BUIE, LOUIS A. Jeep disease (pilonidal disease of mechanized warfare). *South. M. J.*, 37: 103–109, 1944.
15. BERMAN, J. K. Synopsis of the Principles of Surgery. St. Louis. 1940. C. V. Mosby Co.
16. BERMAN, J. K., HOUSER, A. D. and KURTZ, W. A. Preoperative scrubbing in abdominal surgery experimental studies. *Ann. Surg.*, 116: April, 1943.
17. BERMAN, J. K., HOUSER, A. D. and KURTZ, W. A. Clinical studies. *Ann. Surg.*, 117: 766–771, 1943.

A TENSE anal haematoma, resulting from rupture of one of the anal veins, commonly occurs on the lateral aspects of the anal margin, and it is in this situation that excision of the swelling is most suitably carried out. The operation should be done when the haematoma is single and tense, before the overlying skin has become ulcerated and before the clot has discharged with risk of local infection.

From "Minor Surgery" edited by Humphry Rolleston and Alan Moncrieff (Philosophical Library).

REFRIGERATION ANESTHESIA

DERMONT W. MELICK, M.D.
Assistant Surgeon, State of Wisconsin General Hospital
MADISON, WISCONSIN

REFRIGERATION anesthesia may be defined as a type of topical anesthesia resulting from the reduction of local temperature. The use of this type of anesthesia for amputation of the lower extremity has been reported with increasing frequency. To date, however, there have been too few reports comparing the end results of amputation with refrigeration anesthesia and the end results of amputation using other methods of anesthesia. This paper attempts such a comparison. A total of ninety-three amputations are presented. Refrigeration anesthesia was used in twenty-three and other methods of anesthesia in seventy.

CLINICAL EXPERIENCE

The technic used was similar to that recently reported by Cayford and Pretty and need not be repeated here. Suffice it to state that cracked ice was used to accomplish hypothermia and a tourniquet was used in all cases. In some few cases refrigeration was used primarily for purposes of detoxification. When the latter group is included, a total of thirty patients have been subjected to refrigeration in one form or another. In twenty-three of these cases amputation was eventually performed successfully. These patients as well as the individuals having amputations under anesthesia other than refrigeration were all elderly individuals. They were suffering with either diabetic or arteriosclerotic gangrene of the lower extremities. Such individuals were universally poor surgical risks. Not infrequently the gangrenous extremity was the least of their afflictions. Such individuals are poor ones to use as a base line for comparison of methods of anesthesia. It should be definitely understood however that refrigeration was not used exclusively for the poorest risks. In both of the series the amputations were either low thigh or mid thigh.

RESULTS—REFRIGERATION ANESTHESIA

Immediate thigh amputation	19		
Delayed thigh amputation... (Preoperative detoxification refrigeration)	4		
Total amputations	23	→ 28	30 Total Cases of Refrigeration
Failures	5		
Deaths	4		
(17.3%)			

NON-REFRIGERATION ANESTHESIA

Immediate thigh amputation	68		
Delayed thigh amputation... (Preoperative detoxification refrigeration)	2	→ 2	
Total amputations	70		
Deaths	13		
(18.4%)			

Principal Anesthetic Agents

1. Cyclopropane..... 60%
2. Spinal..... 16%
3. Nitrous oxide..... 12%
4. Pentothal..... 7%

The above table gives in brief the results obtained. In addition the following observations were recorded: *For refrigeration anesthesia:* (1) Pain and psychic reaction resulted in failure to obtain satisfactory anesthesia in 17 per cent of the cases. (2) Three patients vomited in the postoperative period. (3) Two patients had pneumonia in the postoperative period. (4) two patients were psychotic in the postoperative period. (5) Wound healing was prolonged in practically all cases. In one there was severe infection. In another gas gangrene resulted in death. (6) One patient died of pulmonary embolism. It was thought the application of the tourniquet contributed the trauma causing release of the clot into the general circulation. *For non-refrigeration anesthesia:* (1) Thirteen

of the patients vomited in the postoperative period. (2) Five patients developed pneumonia in the postoperative period. (3) Two patients were psychotic in the postoperative period. (4) Wound healing was satisfactory with but few exceptions. In three superficial infection delayed wound healing. In one gas gangrene resulted in death.

The fact that the mortality rate is practically identical for both series is worthy of particular attention. It was concluded that the application of a tight tourniquet was not a harmless procedure despite refrigeration. Cayford and Pretty believe that the tourniquet should be eliminated as a part of the method.

Especial comment is in order regarding the procedure of detoxification refrigeration. Six patients exhibited toxicity resulting from severely infected, gangrenous extremities. In each case there was a period of delay from a few hours to five days before amputation. During this time the extremity was packed in either ice or ice bags. We were favorably impressed by the improvement in the clinical condition of certain of these individuals. In three a tourniquet was applied on the assumption that it would enhance the refrigeration and prevent absorption of toxins into the general circulation. In two of these patients the period of detoxification refrigeration failed to exert a beneficial effect on their clinical course, and they subsequently died following amputation under refrigeration anesthesia. In the third case a decrease in toxicity was apparent and amputation was accomplished with survival of the patient. In the remaining three cases a tourniquet was not used and clinical improvement occurred in all three. Two subsequently had amputation performed under refrigeration anesthesia and one under general anesthesia. All three of these patients survived. In view of the improvement of the patients in whom the tourniquet was not used it is believed a tourniquet is also unnecessary for this type of case. The two deaths following the use of the tourniquet emphasized this conviction. The circulation in the gangrenous extremity is poor and refrigeration undoubtedly reduces further the effective circulation. If this is true, the tourniquet can serve no useful purpose.

COMMENT

Three hundred years ago the Italian Severino suggested that ice and snow might be used for surgical anesthesia. The re-introduction of this type of anesthesia was made by Allen of New York, in 1941. Variations of temperature reduction have been suggested for numerous conditions both medical and surgical. The name of Temple Fay is well known to everyone familiar with methods for reduction of the general body temperature. Reduced temperatures under dry conditions have been suggested for the treatment of immersion foot, frostbite, traumatic arterial spasm and peripheral embolism. It has been used to allay pain and decrease toxicity in severe burns. It has also been used for cases requiring incision and drainage, as well as minor operations, to the fingers and toes. Small tumors and skin grafts have been removed successfully. In military surgery it has been suggested for use in wounds in view of its successful employment in civilian practice. Mention has been made of the possibility of the application of a tourniquet around the mid-abdomen for refrigeration below the umbilicus. Allen reports that Blakemore, Lord and Stefko were able to amputate dogs' legs, refrigerate them for twenty-four hours, and then replace them surgically with subsequent full recovery of normal function. In all fairness to the latter authors the following is taken verbatim from their article, "after reimplantation of the limbs there is every evidence of a good supply of arterial blood in the reimplanted legs." Nothing is said about a return of the limbs to normal function. Nothing is said about the end result. Furthermore

these authors were primarily interested in blood vessel anastomosis, not refrigeration.

When injury to tissue, collateral circulation, infection and mortality rates are considered it is common to find confusing statements in the literature. Safford states that tissue temperatures below 50°F. may damage tissue when other factors are present. These factors are: (1) certain types of circulatory obstruction, (2) slight pressure and (3) subsequent warming. Safford qualifies his statements by noting that refrigeration will not cause tissue damage unless it is used for over twelve hours. His recommendations are for a temperature higher than that obtained by the use of ice, namely, a skin temperature of 40 to 50°F. and 45 to 65° for deeper tissues. Richards has indicated that tissues distal to the tourniquet are injured. The damage may not be apparent grossly but is apparent on microscopical examination. The symposium on refrigeration by Large, Bruneau and Heinbecker in the November issue of the *Annals of Surgery* give support to Richards' contentions. Recently, Allen has taken these individuals to task for what he believes is an unwarranted condemnation of refrigeration. He states that repeated examinations of amputated limbs has failed to reveal any pathological changes whatsoever. The observations of Blackwood lend weight to the contentions of Richards, Large, Bruneau and Heinbecker. Blackwood states it is known in tissue culture work that a temperature zone between 50 and 80°F. slows anabolic processes while katabolism proceeds and metabolites accumulate. In muscle the accumulation of metabolites means an increase in its lactic acid content and myosin, the main constituent of muscle protein, is unstable on the acid side of neutrality.

From a physiological standpoint the establishment of collateral circulation in the refrigerated extremity does not seem feasible because of the arterial spasm caused by the cold. There are some who believe that the initial spasm is eventually abolished and that cold preserves the damaged extremity until collateral circulation can be established. Others state a paravertebral sympathetic block is necessary for alleviation of the arterial spasm.

Infection is thought to be held in check and minimized by slowing the metabolism and preventing bacterial growth. It seems equally logical to assume that prolonged cold sets the stage for a really severe infection once the refrigeration is stopped. The experiments of Large and Heinbecker lend credence to the last statement.

The mortality rate for amputations in elderly patients has presumably been markedly reduced if refrigeration was chosen as the method of anesthesia. If a reduction of mortality rate from a percentage of 75 to 25 could be demonstrated and charged off to the efficacy of this method, its justification would be undoubted. Such a reduction, one must remember, might be more apparent than real. A change from poor methods and poor management to improved methods and better management should result in a mortality rate approaching the lower percentage. Refrigeration anesthesia in such a situation might be given the credit when in reality it is only co-incidental with a change for better preoperative and postoperative care. The mortality rate in the series presented here is no better with refrigeration than the group not subject to refrigeration. In both series, however, the mortality rates are considered to be better than average when compared with other similar series of amputations. The usual mortality rate for amputations using refrigeration anesthesia is well over 20 per cent. To date the best that can be claimed for any one group of amputations using refrigeration is 12 per cent. Recently McKittrick performed 132 consecutive major amputations for diabetic gangrene with a mortality rate of only 3.8 per cent. Can the spinal anesthesia he used for this remarkable accomplishment be given all the credit?

This directs attention toward the anesthetic agents, exclusive of refrigeration, used in the amputations herein presented. It was not possible to designate any one of them as the ideal anesthetic for the particular operation in question. This inability to recommend the ideal anesthetic, emphasizes a belief that it is not important what anesthetic is used, as long as the person administering the anesthetic is well qualified. So much the better if this happens to be a physician practicing anesthesia as a specialty. When anesthesia is supervised by such an individual, it can be said without fear of contradiction that the mortality rate for this or any other given procedure will show a decided change for the better.

Regarding the final impression after personal experience and a review of the literature it is sufficient to state that the extent to which refrigeration anesthesia or other variations are acceptable is as yet unsettled. It has been pointed out that every new anesthetic before becoming firmly established must pass through three stages: a period of optimism, a period of pessimism and a period of adjustment. The suggested applications for refrigeration cover a wide field that will be narrowed only by trial and error. Particularly is this true of reduced temperature necessary for actual anesthesia. Allen's admonition in 1941 that undue enthusiasm should be avoided for this spectacular novelty in order to avoid disillusionment remains good advice in 1945.

SUMMARY

A series of twenty-three cases of amputation of the lower extremity under refrigeration anesthesia is presented. A second series of seventy cases of amputation with anesthesia other than refrigeration is also presented. The mortality rate for the refrigeration series was 17.3 per cent and for the non-refrigeration series 18.4 per cent.

CONCLUSION

Refrigeration anesthesia does not offer advantages over any other type of anesthesia for amputations of the thigh in elderly, poor risk patients.

The use of refrigeration for purposes of detoxification of infected, gangrenous extremities has a limited field of usefulness as a preliminary to amputation.

REFERENCES

1. Allen, F. M., Crossman, L. W. and Safford, F. K. Reduced temperature treatment for burns and frost-bite. *New York State J. Med.*, 43: 951, 1943.
2. Adolph, P. E. Preoperative measures used in war surgery in China; with special reference to the delimiting tourniquet. *Ann. Surg.*, 119: 246, 1944.
3. Blakemore, A. H., Lord, J. W. and Stefko, P. L. Restoration of blood flow in damaged arteries; non-suture method of blood vessel anastomosis. *Ann. Surg.*, 117: 481, 1943.
4. Bowers, W. F. Refrigeration therapy in vascular trauma. *Mil. Surg.*, 93: 289, 1943.
5. Brooks, B. and Duncan, G. Influence of temperature on wounds. *Ann. Surg.*, 114: 1069, 1941.
6. Crossman, L. W., Ruggiero, W. F., Hurley, V. and Allen, F. M. Reduced temperatures in surgery. II. Amputation for peripheral vascular disease. *Arch. Surg.*, 5: 171, 1942.
7. Crossman, L. W. and Allen, F. M. Refrigeration anesthesia and treatments. *Anesth. & Analg.*, 22: 264, 1943.
8. Haley, E. R. Arteriosclerotic gangrene: a report on refrigeration prior to amputation. *Arch. Surg.*, 46: 518, 1943.
9. McElvenny, R. T. Present status of cooling limbs in preparation for surgical procedures. *Am. J. Surg.*, 58: 110, 1942.
10. Mock, H. E. and Mock, H. E., Jr. Refrigeration anesthesia in amputations. *J. A. M. A.*, 123: 13, 1943.
11. Mock, H. E. and Tannehill, E. H. Fractured pelvis complicated by gangrene of extremity—amputation under refrigeration anesthesia. *Surg., Gynec. & Obst.*, 78: 429, 1944.
12. Richards, Victor. Refrigeration anesthesia in surgery. *Ann. Surg.*, 119: 178, 1944.
13. Mock, H. E., Jr. Refrigeration anesthesia in skin grafting. *J. A. M. A.*, 122: 9, 1943.
14. Brooks, B. The effects of temperature on the survival of anemic tissue. *Ann. Surg.*, 112: 130, 1940.
15. Blackwood, W. and Russell, H. Experiments in the study of immersion foot. *Edinburgh M. J.*, 50: 385, 1943.
16. Allen, F. M. Theoretical and experimental aspects of surgical refrigeration. *Canad. M. A. J.*, 51: 220, 1944.
17. Safford, F. R. and Nathanson, M. B. Clinical observations on tissue temperatures. *Arch. Surg.*, 49: 12, 1944.
18. Massie, Francis M. Amputation with refrigeration anesthesia. *South. M. J.* 37: 1, 1944.

19. Segerberg, L. H. Methods of mortality reduction in amputations for arteriosclerotic gangrene. *Rocky Mountain M. J.*, 40: 663, 1943.
20. Meade, F. C. and Sheppard, R. C. Refrigeration anesthesia for amputation, with reports of eleven cases. *Bull. School Med., Univ. Maryland*, 28: 80, 1943.
21. Hinchey, Paul R. Refrigeration in surgery of the extremities. *New England J. Med.*, 230: 63, 1944.
22. Friederwitzer, H. H. Ice as a local anesthetic. *Med. Rec.*, 157: 42, 1944.
23. Schiebel, H. M. The use and evaluation of anesthesia by "freezing" for surgery of the extremities in diabetic patients. A case report. *North Carolina M. J.*, 2: 227, 1942.
24. Allen, F. M., Crossman, L. W., Hurley V., Warden, C. and Ruggiero, W. Refrigeration anesthesia. *J. Internat. Coll. Surg.*, 5: 125, 1942.
25. Allen, F. M. and Crossman, L. W. Suggested uses of refrigeration anesthesia including war surgery. *Arch. Phys. Therap.* 23: 711, 1942.
26. Nixon, E. A. Amputation anesthesia by freezing. *Northwest Med.*, 42: 131, 1943.
27. Allen, F. M. Refrigeration anesthesia for limb operations. *Anesthesiology*, 4: 12, 1943.
28. Rupp, Nevin H. Modern concepts of refrigeration anesthesia. *Anesth. & Analg.*, 22: 46, 1943.
29. Allen, F. M. Reduced temperatures in surgery. I. Surgery of limbs. *Am. J. Surg.*, 52: 225, 1941.
30. Egan, R. L. Refrigeration treatment of peripheral vascular diseases. *Nebraska State M. J.*, 29: 217, 1944.
31. Cayford, E. H. and Pretty, H. G. Refrigeration anesthesia and evaluation of amputation sites by arteriogram. *Ann. Surg.*, 121: 157, 1945.
32. Large, A. and Heinbecker, P. Refrigeration in clinical surgery. *Ann. Surg.*, 120: 707, 1944.
33. Bruneau, J. and Heinbecker, P. Effects of cooling on experimentally infected tissues. *Ann. Surg.*, 120: 716, 1944.
34. Large, A. and Heinbecker, P. The effect of cooling on wound healing. *Ann. Surg.*, 120: 727, 1944.
35. Large, A. and Heinbecker, P. Nerve degeneration following prolonged cooling of an extremity. *Ann. Surg.*, 120: 742, 1944.
36. Neller, J. L. and Schmidt, E. R. Refrigeration amputation. *Wisconsin M. J.*, 43: 936, 1944.
37. Allen, F. M. The status of refrigeration for military surgery. *Arch. Phys. Med.*, 26: 92, 1945.
38. Blalock, A. Effects of lowering temperature of an injured extremity to which a tourniquet has been applied. *Arch. Surg.*, 46: 167, 1943.
39. O'Neil, E. E. The use of refrigeration in amputation and peripheral vascular disease. *New England J. Med.*, 230: 209, 1944.
40. Doane, J. C. Proof of the practicability of refrigeration anesthesia. *Mod. Hosp.*, 60: 64, 1943.
41. Allen, F. M. Reduced temperatures in surgery; surgery of limbs. *Am. J. Surg.*, 52: 225, 1941.
42. McElvenny, R. T. The effect of cooling traumatized and potentially infected limbs. *Surg., Gynec. & Obst.*, 73: 263, 1941.
43. Perlow, S. Refrigeration anesthesia in leg amputations. *U. S. Naval Med. Bull.*, 42: 433, 1944.
44. Allen, F. M. Refrigeration anesthesia for limb operations. *Anesthesiology*, 4: 12, 1943.
45. Newman, M. K. Present status of therapeutic hyothermy. *Arch. Phys. Therap.*, 24: 389, 1943.
46. Bigelow, W. G. and Lanyon, E. C. G. Uses for dry cold therapy. *Brit. M. J.*, 1: 215, 1944.
47. McKittrick, L. S. and Pratt, T. C. The principles and results after amputation for diabetic gangrene. *Ann. Surg.*, 100: 638, 1934.
48. McKittrick, L. S. Personal communication.
49. Brooks, Barney. Personal communication.
50. Blalock, A. Effects of continuous and intermittent application of a tourniquet to a traumatized extremity. *Arch. Surg.*, 48: 489, 1944.
51. Goldstone, B. W., Corbett, H. V.: Etiology of immersion foot. *Brit. M. J.*, 1: 218, 1944.
52. Jones, A. J., Graham, J. and Mueller, A. Local and general temperature reduction in malignancy. *Am. J. Surg.*, 52: 14, 1941.

TREATMENT OF INTERTROCHANTERIC FRACTURES OF THE FEMUR*

THE USE OF THE HANGING CAST

CAPT. JOSEPH L. POSCH
MEDICAL CORPS,
ARMY OF THE UNITED STATES

AND

WILLIAM E. ABBOTT, M.D.
DETROIT, MICHIGAN

THE treatment of intertrochanteric fractures of the femur has been recently well summarized by Stuck.[1] He presents the three main methods of treating these fractures and criticizes each as follows:

1. External splints or casts confine the patient to such a degree that a change of position is difficult. This confinement encourages the formation of pressure ulcers, muscular wasting, and residual joint stiffness that may delay general recovery.

2. Traction devices hold the patient in a supine position, and because of this, bedsores and hypostatic pneumonia occur rather frequently. "Well leg" traction does permit patients to be turned or with assistance to be placed in a wheel chair, but since the knees and ankles are held immobile for many weeks, there is much residual stiffness and weakness.

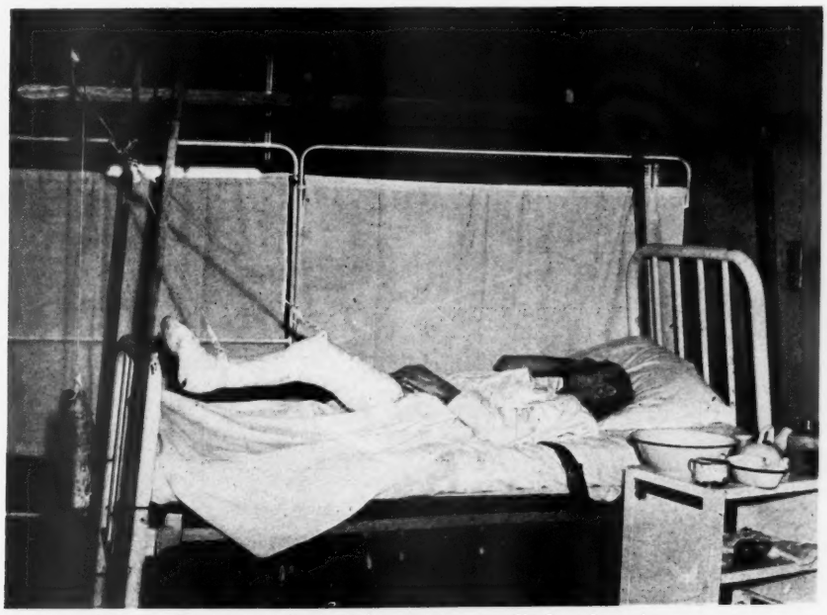


FIG. 1. Patient in bed with traction applied to hanging cast.

3. Internal fixation is usually the method of choice because it allows free motion of the legs and frequent change of position in bed and out. At times, however, intertrochanteric fractures are so badly comminuted and the condition of the patient such that it is impossible to use internal fixation.

A method of treating intertrochanteric fractures by means of a hanging cast was recently described by Johnson.[2] By this method the mortality rate in his series of over fifty cases was decreased from 39.3 to 18 per cent and the duration of hospitalization shortened by twenty-two days.

* From the City of Detroit Receiving Hospital and the Department of Surgery of Wayne University College of Medicine, Detroit, Mich.

The application of the cast is a simple procedure and is done under local anesthesia. After satisfactory sedation a Steinmann pin is inserted through the lower end of the femur. The purpose of this pin is the prevention of pressure sores and peroneal nerve paralysis, which might occur if enough weight were attached to the cast for reduction of the fracture. Stockinet on the leg and felt padding over the bony prominences is applied up to the mid-thigh region. Then the usual mid-thigh cast is applied, the Steinmann pin being incorporated and the knee placed at 30 to 40 degrees of flexion. The thickness of the cast is varied according to the amount of weight desired, a lighter cast being employed for a smaller person and a fairly heavy cast for a larger person.

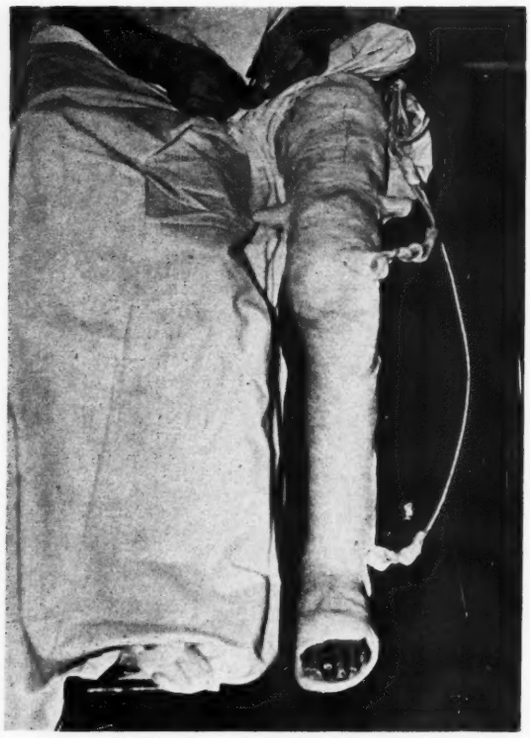


FIG. 2. Cast is permitted to hang when patient is in a wheel chair.

Plaster loops are then made from narrow plaster slabs and incorporated in the cast at the knee and the ankle, on the anterolateral aspect so that when traction is applied to these the external rotation is corrected. When the plaster has adequately hardened, traction cords may be attached to these loops and from 20 to 35 pounds of weight applied. The pulley is placed at the foot of the bed on the affected side so that abduction is obtained. (Fig. 1.) Traction is employed only when the patient is resting in bed. When the patient is in a chair or on crutches, the weight of the hanging cast gives sufficient traction.

Within several days after the application of the cast, the patient is placed in a wheel chair (two hours twice daily) with the footboard on the affected side turned up, thus allowing the extremity to hang. (Fig. 2.) Some pain is usually encountered when the patient is first put in a wheel chair, but it has been noted that if gentle traction is applied, as advocated by Johnson,[2] the pain is minimized. After one to two weeks, less pain is encountered, and the patient can be up more frequently for longer periods of time. The patient is allowed on crutches after the third week if tolerated. Bearing weight on the affected extremity is not permitted for about three months.

RESULTS

The hanging cast has been employed in treating fourteen patients, eleven women and three men, whose ages ranged from forty-eight to ninety-one years. The results are shown in Table 1 on the first eleven patients; the last three patients not being included because sufficient time has not elapsed to evaluate the final results. In almost each instance, the patient treated in this fashion had sustained a severe comminuted intertrochanteric or subtrochanteric fracture that was not suited to treatment by internal fixation.

In several of the cases so treated some stiffness of the knee was encountered after removal of the cast. This apparently resulted from a too prolonged period of immobilization in plaster. However, this residual stiffness responded well to treatment. To prevent or minimize this stiffness it seems wise to remove the cast in

thirty-five to fifty days and to institute physiotherapy.

Occasionally when elastic bandages were ulcers occurred even though the patients were taken out of bed for two to three hours two times a day. However, because

TABLE I

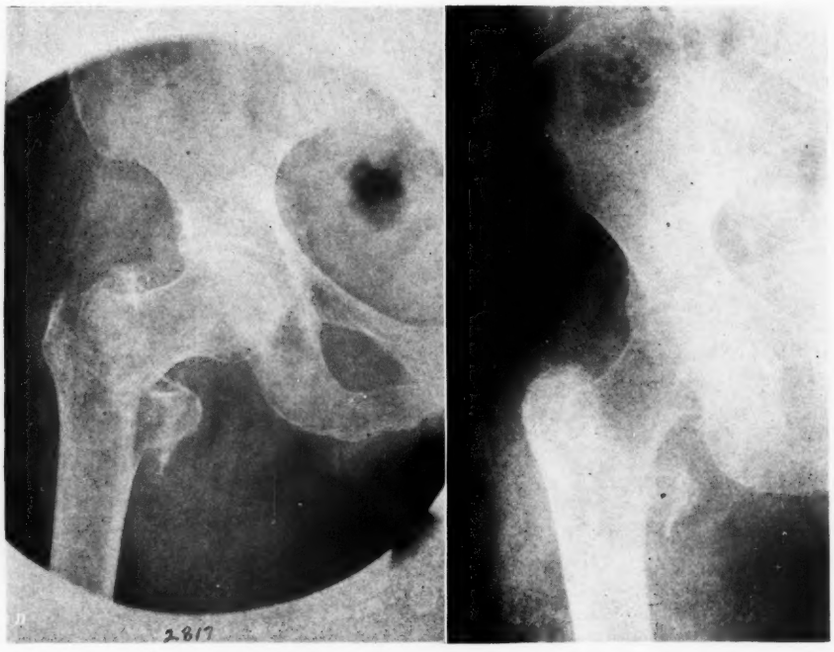
SUMMARY OF RESULTS

Patient	Age	Sex	Type of Fracture	Days after Injury That Callus Formation Was Noted	Removal of Cast	Results and Complications
E. S.	73	F	Extensive comminuted intertrochanteric fracture of the right femur	..	.....	Cardiac patient; expired 12 days after admission
R. L.	83	F	Right intertrochanteric fracture	10	40 days	Mild bedsore developed even though patient was up twice daily. Healing of fracture and position excellent
A. M.	65	F	Left intertrochanteric fracture extending down shaft	32	35 days	Results good
A. Mc.	48	F	Extensive left intertrochanteric fracture with slight lateral angulation and upward displacement of the shaft	17	38 days	Results excellent at the time patient was discharged to a convalescent home
R. W.	76	F	Extensive comminuted left intertrochanteric fracture	21	35 days	Bedsores developed. Excellent position and healing
H. E.	72	M	Right subtrochanteric fracture with impaction. Old healed fracture of the right femoral neck	18	55 days	Complete bony union with excellent position in 20 weeks. Patient walked with cane.
J. M.	67	M	Old fracture of the neck of the left femur	..	.....	No evidence of healing in 30 days
M. M.	78	F	Extensive intertrochanteric fracture of the left femur	22	42 days	Left hospital against advice in 25 days; end result when checked later good
M. B.	49	F	Right intertrochanteric fracture	19	51 days	Because of inadequate traction and abduction, healing was slightly delayed; it was ultimately satisfactory
J. K.	48	F	Intertrochanteric fracture of the right femur	20	13 weeks	Excellent results
M. S.	87	F	Intertrochanteric fracture of right femur	16	46 days	Patient up in wheel chair daily. Callus present in 16 days; position excellent

not applied to the affected extremities following the removal of the cast, edema was encountered.

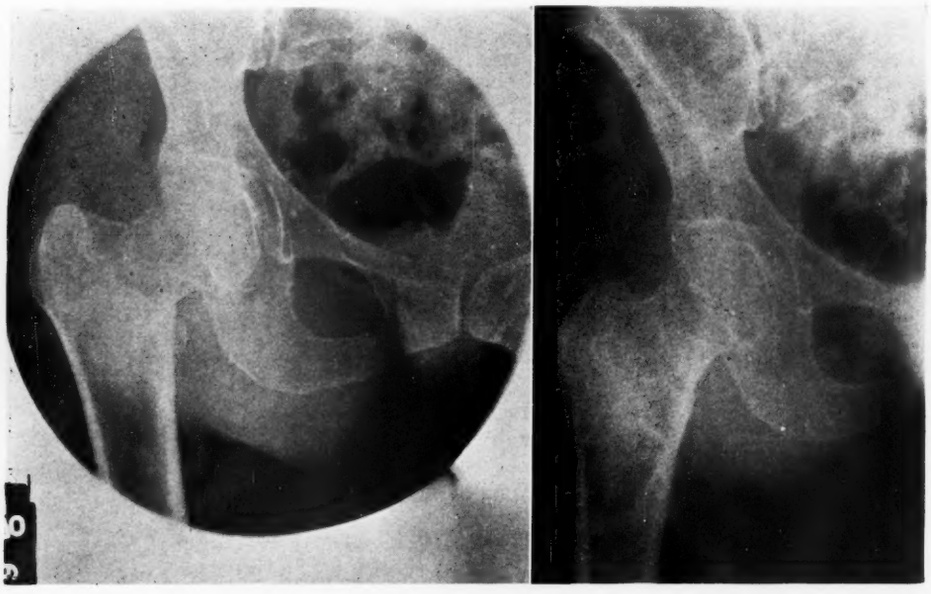
In two of the older cases decubital early callus formation had occurred, it was possible to remove the cast and thus permit the patient to lie on his abdomen or side. These two patients were seventy-six and

eighty-three-year-old women who had urinary incontinence and definite mental deterioration due to senile changes.



A B

Fig. 3. A, admission *x*-ray of the right hip of a seventy-three-year old woman who sustained an extensive comminuted intertrochanteric fracture. B, position after five days of treatment. Note the good valgus position already obtained.



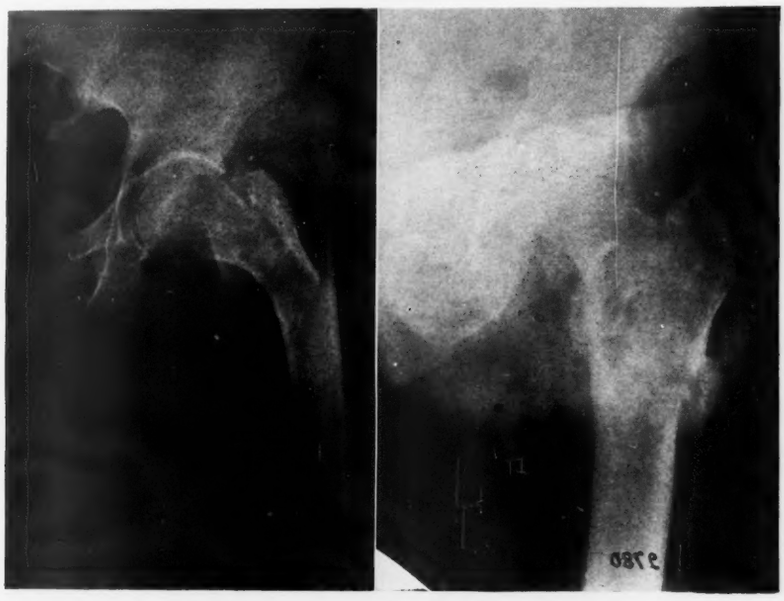
A B

Fig. 4. A, admission *x*-ray of the fractured right hip of an eighty-three year old woman. B, position at ten days. The roentgenologist reported good position and early callus formation.

One patient with a fracture of the femoral neck was first treated with a Smith-Petersen nail; the nail later slipped, was removed, and a hanging cast applied two weeks after the injury. When no evidence of healing occurred in six weeks, the hanging cast treatment was discontinued.

From the fourteen patients treated we have found that the hanging cast is more effective in the smaller, non-obese patient.

The end result on the fourteen patients studied has been quite satisfactory. While the number of patients is too small to evaluate the method accurately, a brief summary might be of interest.



A B

FIG. 5. A, admission *x*-ray of the left hip of a forty-eight-year old woman who sustained an extensive intertrochanteric fracture with slight lateral angulation and upward displacement of the shaft. B, position at thirty-eight days. Moderate bony union was present. Callus formation was noted as early as seventeen days.

It is believed that callus formation is as rapid as in other forms of treatment and possibly even accelerated. We have also noted a good valgus position in each instance. On several occasions the first *x*-ray showed a coxa vara position that was easily corrected by increasing the abduction. It is believed that by employing the hanging cast method, adequate position can always be obtained if the physician takes the time and effort to see that the cast is hanging properly (adequate weight, rotation, and abduction). It is usually advisable to check the position by *x*-ray every few days until good position is obtained.

CONCLUSION

From this study we can conclude that although internal fixation is still the method of choice in handling the majority of intertrochanteric fractures, instances will occur (badly comminuted fractures, poor general condition of the patient) in which the hanging cast can be effectively employed.

Of fourteen patients treated with the hanging case for an intertrochanteric or femoral neck fractures, one patient succumbed (mortality rate 7 per cent). The position of the remaining cases and the motion at the hip joint was good. Some stiffness of the knee and ankle joints occurred although in most instances this was adequately overcome by physiotherapy. In comparison to patients treated by methods other than internal fixation it was believed that the results obtained were quite satisfactory, especially since most of this group of patients were not suitable for nailing, due to an extensive comminuted fracture.

REFERENCES

1. STUCK, W. G. The treatment of intertrochanteric fractures of the femur. *Surgery*, 15: 275, 1944.
2. JOHNSON, M. D. The treatment of intertrochanteric fractures of the femur with a hanging cast. *Surg., Gynec. & Obst.*, 77: 598, 1943.

NEWER POSTOPERATIVE TRENDS*

DeWitt C. Daughtry, M.D.
Instructor in Surgery, Medical College of Virginia
RICHMOND, VIRGINIA

IN discussing a topic of such broad scope only the more important advances can be given due consideration. There have been a great number of recent new and improved conceptions. It is difficult to discuss postoperative care without mentioning preoperative care, as it is usually a continuation of the latter. At the outset the uncomplicated postoperative course will be considered.

NUTRITIONAL CONSIDERATIONS

One is so often preoccupied with the primary or specific treatment of the disease that details such as dietary management are entirely forgotten.[1] Regardless of all other factors involved, the patient cannot be expected to have a smooth and uneventful convalescence unless proper nutrition is maintained. Food, water, minerals and vitamins are indispensables.

Food in order to be of value must be ingested, absorbed and metabolized. Often large meals are offered the patient but one seldom takes the trouble to note how little is ingested. Failure to take food may be due to weakness, anorexia, nausea or discomfort. The reason should be ascertained and analyzed. Adequate calories, minerals, vitamins and proteins can be given in the form of a fluid diet.[1] Practically all foods with the exception of milk are transformed into fluids upon reaching the stomach. Solid foods may be tolerated much earlier than usually prescribed and, in fact, will often help relieve distention and cramps. They should be given as early as possible. In other words, food should be taken in the usual manner as early as possible. Fruit juices and milk are not often well tolerated during the early postoperative course as both have a tendency to be gas forming. Fluids given should be warm or at room temperature. Mild alcoholic beverages are often well tolerated by chronic alcoholic patients. It is good psychology to give small feedings and let the patient ask for more. It makes them think they are really improving.

Water requirement varies a great deal and is dependent on many factors such as the nature and severity of the illness, body temperature, atmospheric temperature, and whether there is vomiting or increased loss of fluids.[1] The required fluid intake of an ill person varies from 3,000 to 7,000 cc. daily.[1] A moderately ill individual not losing a large quantity of fluids may need only 3,000 cc., while another with a high fever, vomiting or losing large quantities of fluids, or one who is dehydrated may require a much larger fluid intake.

The urinary output is a good index as to whether the fluid intake is sufficient. The urinary output should be sufficient to excrete the waste products without depleting the water stores in the body. The daily urinary output should be at least 1,000 cc. and preferably 1,500 cc. The specific gravity for the twenty-four-hour specimen should not exceed 1.020.[1]

Mineral metabolism is of importance in the management of the postoperative patient; however, in this paper the discussion will be confined to sodium chloride. When the salt intake is insufficient, water is not retained in the body because of salt depletion and dehydration ensues.[1] It is fairly well established that a sodium ion

* From the Surgical Department of St. Mary's Hospital, Duluth, Minnesota. Presented before the Duluth Surgical Society on April 27, 1944.

depletion predisposes to circulatory failure. There is also decreased thirst, appetite and general vigor of the individual.[1] The normally functioning kidneys selectively retain sodium and chloride ions, while the poorly or abnormally functioning kidneys continue to excrete both regardless of salt intake. Salt depletion may result from persistent vomiting, diarrhea or excessive perspiration. The normal salt intake should approximate 5 Gm. but this should be almost doubled in a sick individual because of the increased amount of fluids lost. Salt may be easily given in the diet and fluids ingested. If in doubt as to the salt intake or retention, a blood chloride determination will give the answer.

Vitamins are essential to the maintenance of health and it is obvious that they are likewise essential for smooth convalescence. It should be remembered that certain diseases decrease vitamin absorption and increase their excretion as well as requiring increased amounts for tissue repair. The best preventative against vitamin deficiencies is a generous, well balanced diet.[1] In many postoperatives that is not possible, therefore, vitamins must be furnished by other means. Various forms of vitamins may be given by mouth early in the postoperative course but it should not be forgotten that often the purpose is defeated by destroying or decreasing the already inadequate appetite. Vitamins are probably better given parenterally during the early postoperative course.[1]

The problem of food intake should be further analyzed. It is well known that protein is indispensable and cannot be replaced by other foods. The normal individual requires a protein intake of approximately 1 Gm. per kilogram of body weight per day. In a well person the protein intake can be reduced somewhat if a high caloric diet is administered. When it comes to seriously ill individuals the protein requirement often rises to three or four times the normal, of which very little can be replaced by other foods.[1] Thus, the necessity arises for giving proteins in large enough quantities to prevent protein depletion. If protein depletion takes place, liver damage is sure to follow with resulting depletion of serum proteins, and this in turn produces nutritional edema. Those who are familiar with the Japanese atrocity stories will remember that most of the prisoners of war are reported as being edematous. Their diet is chiefly rice and proteins are nil. Every effort should be made to administer high protein diets in seriously ill patients and in patients who are expected to have a prolonged convalescence. It is suggested by one investigator that the anti-body reaction may be closely associated with protein metabolism.[2] We realize now that solid foods may be tolerated much earlier than ordinarily prescribed. Patients unable to take solid foods will often tolerate milk and eggs in their various forms. If there is a limitation to the amount and variety of food that can be ingested, the choice should be proteins.

Carbohydrates are necessary, but for a short period the body may subsist on an intake of 100 Gm. daily. This amount is probably sufficient to prevent ketosis. The remainder of the calories may be derived from protein breakdown and from fat stores in the body.[1] However, in serious illnesses such a gamble should not be taken, and the intake should approximate 300 Gm. of carbohydrates daily. It is important to remember that vitamin B_1 is necessary for proper carbohydrate metabolism.

The required fat intake is variable depending upon the amounts of proteins and carbohydrates taken. If the above are taken in sufficient quantities, fat can be regarded as almost dispensable. Let it not be forgotten, that fat may be advantageously given under certain circumstances for it is high in calories and may be useful when the amount of intake is limited.[1]

Oral feeding is often impossible or it may be unwise to attempt to maintain

proper nutrition without resorting to other routes. One's ingenuity may be taxed in attempting to maintain the nutritional state in certain postoperative cases such as peritonitis, paralytic ileus, intestinal obstruction and many others. Parenteral feeding, including tube feeding, is gaining a great deal of recognition. Tube feeding should not be resorted to until all other means or attempts at getting the patient to take the necessary food have failed. Patients will often begin eating if told that tube feeding will be discontinued when adequate food is taken by mouth. If gavage be necessary, the feedings should be small, nutritious, warm and injected very slowly. Amigen,* an hydrolysate of casein, is a good form of protein and is usually well tolerated. This form of food may be given by mouth, by gavage, intramuscularly and intravenously. It should be added that there are other parenteral protein products on the market. Parenteral feedings are substitutes and only substitutes for normal eating.[1] They should be given only when definitely indicated. All surgeons realize that parenteral feedings are absolutely necessary in certain cases and should be begun early and before serious dietary depletions have resulted. This method of feeding should be cautiously prescribed and administered with the greatest of care. The speed of administration depends upon the route used and the substance being given. If administered too rapidly, serious reactions may result and if given too slowly, undue fatigue and exhaustion may result. The fluid intake should be sufficient to replace water lost by breathing, from the skin, vomiting, diarrhea, urine, exudation and transudation.[1] Parenteral fluids administered should contain enough salt to take care of the normal excretion plus any unusual loss, such as by vomiting or excessive perspiration. Isotonic saline may readily be administered subcutaneously and intravenously. Isotonic (5 per cent) glucose may be given subcutaneously but higher percentages can be given only intravenously. Let it be remembered that 5 per cent glucose in physiological saline cannot be given subcutaneously without untoward reactions because the combination of the two forms a hypertonic solution. Hypertonic glucose should be given slowly in order to prevent unnecessary damage to the vein walls, resulting in thrombosis. Furthermore, some patients complain of an uncomfortable fullness in the abdomen when hypertonic fluids are given rapidly. If large amounts of glucose are given by vein, they should be given in divided doses to maintain continuous utilization and to prevent undue excretion of glucose in the urine. Until recently, the only forms of protein that could be given parenterally were whole blood, plasma and serum. Great strides have been made and are in the process of being made along this line. Now, hydrolyzed proteins and mixtures of amino acids are available for parenteral use. The writer has used them in a number of cases and the results have been satisfactory. If given in sufficient quantities, nitrogen equilibrium may be maintained. Vitamins may likewise be given parenterally for prophylactic and therapeutic purposes.

* Amigen is an enzymic digest of casein and pancreas, containing amino acids and polypeptides. Mead Johnson & Co., Evansville, Ind.

GENERAL PRINCIPLES

Miscellaneous considerations should receive some mention. The abdominal cavity should not be irrigated. On the other hand, all blood and foreign material should be aspirated or removed by sponging. Peritoneal drainage is, as a rule, contraindicated.[3] Dressings should not be too large. They should be snugly applied but not tight, especially is that true of the upper abdomen. Cold applied to postoperative wounds often adds to the comfort of the patient.[4]

The position of the postoperative patient has received considerable comment recently. The trend is toward the Trendelenburg position, but each case should be individualized. Some surgeons believe that

fewer headaches follow spinal anesthesia when the semi-Fowler's position is utilized immediately postoperatively.

Wounds in vitamin C deficiency individuals heal slowly and with poor tensile strength.[5] Cod liver oil ointment applied locally to wounds is thought to stimulate granulation and epithelization.[6,7] It is not at all confirmed that the vitamin content is responsible for the healing qualities. Antiseptic, including alcohol, should not be placed in open wounds as wound healing is definitely prolonged. Normal saline solution is the most satisfactory agent to use for warm moist compresses. However, such applications should not be applied continuously because of maceration of the skin. *X*-ray therapy is often a valuable adjunct in the treatment of infections. Do not redress clean wounds until time for the sutures to be removed. Sutures should be removed on or about the seventh day and clips a day or two earlier.

Patients should be gotten up as soon as practicable. Following uncomplicated appendectomy, the patient may be allowed up in two to five days. An effort should be made to keep the patient's morale at a high ebb. Visitors should be few and the visits short. Visitors should not come to the hospital to tell their troubles or to be entertained.

The physician should see seriously ill patients at least twice daily. Sedatives should be given cautiously. Joints should not be immobilized longer than definitely indicated. The tendency is toward early motion following tendon repairs. Splinting of infected and injured extremities is an important surgical principle. Most deeply imbedded metallic foreign bodies should be treated conservatively.

The anesthetist should accompany the patient to his bed and should not leave him until a nurse has been detailed to remain until the patient is completely conscious. Often there are instructions which the anesthetist should pass on to the responsible nurse. Too many times a shy, inexperienced, student nurse, a nurse's aid or an orderly is left in charge of an anesthetized patient. For practical purposes the patient might as well be left alone. It is desirable to have anesthetic recovery rooms in hospitals accommodating surgical patients. The patient should not be kept too warm because metabolism and fluid loss are thus increased. An electric aspirator should be by the bed of any anesthetized patient and should be used for aspiration of mucus or vomitus from the nose, mouth and throat.

Tracheotomy trays should be on all floors where postoperative thyroid patients are assigned. In fact, if complications are anticipated, the tray should remain in the patient's room for two or three days. Thyroidectomy wounds developing hemetomas should be explored early. Lugol's solution is being given intravenously in an increasing number of postoperative thyroidectomy cases. Contrary to past opinion, sedatives should be used cautiously in these patients. Mild parathyroid tetany may be controlled by calcium lactate and ammonium chloride by mouth. If this treatment is unsatisfactory, resort to dihydrotachysterol. Stone and associates[8] claim some success with the use of parathyroid gland transplants.

Hand surgery is gaining its deserved place in the field of major surgery. The trend is toward guillotine amputation of extremities with application of skin traction by means of adhesive strips. In this manner less of the extremity is sacrificed. Local heat is contraindicated in most vascular lesions of the extremities.

SULFONAMIDES

Something should be said regarding the use of sulfonamides both prophylactically and therapeutically. The use of sulfonamides by mouth, parenterally and especially locally in wounds and in the peritoneal cavity for prophylactic purposes has gained much in popularity. Its value is not to be doubted in the treatment of certain types of lesions[9,10,11] especially war injuries. Sulfonamides are of proven

value in the treatment of many postoperative complications. The trend in civilian practice is away from the use of sulfonamides locally, including intraperitoneal use. Despite its use no surgical "short cuts" should be taken nor any additional daring procedures undertaken.

Well established surgical principles should be observed. In the past, sulfadiazine administered by mouth or parenterally seems to have been more effective than other sulfonamides. At present sulfamerazine is being used in an increasing number of cases. Sulfanilamide is still considered by many to be the best preparation for local use. It is absorbed fairly rapidly and produces little foreign body reaction.

BLOOD AND BLOOD SUBSTITUTES

Much has been said recently concerning the use of blood and blood substitutes in surgery.[12] Whole blood and plasma are of undisputed value in postoperative care. The former is of greatest value in blood replacement whether due to blood loss or anemia. Many speak of its tonic effect upon seriously ill patients. To be of greatest value, whole blood should not be more than ten days old when used. Plasma is used in cases of acute blood loss when whole blood is not immediately available. Otherwise, plasma is of great value in: (1) prevention and treatment of shock; (2) in burns, as a prophylactic measure against hemoconcentration, and (3) in protein replacement and in the building of protein stores. Whole blood and plasma are often not given in sufficient quantities to gain the desired result; this is particularly true of plasma. When plasma is really indicated several units are usually needed. Hydrolysates of casein and mixtures of aminoacids are being used to a limited extent.

COMPLICATIONS AND TREATMENT

Postoperative complications, their treatment and prevention deserve due consideration. Despite the use of sulfonamides, blood transfusions, improved anesthesia, improved surgical technic, penicillin and scores of other advances, complications are ever present and must be dealt with as real surgical problems.

One of the most common postoperative complications is atelectasis. Patients with upper respiratory infections should not be subjected to elective surgical procedures. In the majority of cases of atelectasis the amount of lung involved is small and the only proof is the *x*-ray evidence. The first indication that the patient has atelectasis is a sharp rise in the temperature and pulse rate during the first or second postoperative day. The patient often expectorates a plug of mucus and proceeds to an uneventful recovery without anyone suspecting what has really taken place. In patients with massive pulmonary collapse the temperature rises suddenly to 104° or 105°F. and sometimes much higher. The pulse rate increases correspondingly and the patient becomes cyanotic and dyspneic. These cases require immediate active treatment. In the conservative treatment, steam inhalation and expectorants are thought to be of value. The least that should be done is to support the wound and have the patient cough frequently. The patient's position should be changed frequently. The best position is on the uninvolved side, which is more often the left. As a rule, the patient cannot tolerate this position for any length of time. The treatment of choice is immediate bronchoscopic aspiration and repeatedly in some cases. Tracheal and bronchial aspiration before leaving the operating table, less sedation, frequent change of position, breathing exercises and the use of carbon dioxide inhalations will prevent atelectasis in the majority of cases. Casually written orders are not sufficient. The situation must be adequately explained to the nurse in charge of the patient.

Pneumonia will not be discussed in this paper because it is, without doubt, a product of atelectasis in the majority of instances. In other words, primary postoperative pneumonia is uncommon.

One of the most important problems in surgery is the prevention and treatment of paralytic ileus. Its presence to a variable extent is almost 100 per cent following intra-abdominal and renal operations. The cause is probably reflex. Gentle manipulation of the viscera is a great factor in its prevention. The careful use of retractors should be stressed. This complication should be anticipated in many cases and prophylactic measures instituted. The prophylactic and early use of intestinal suction is an important factor in preventing or minimizing this frequent and troublesome complication. It should be added that gastroduodenal suction is of very little value. No drugs are of proven value. Prostigmine is of questionable value as a prophylactic measure and appears to have no beneficial effect after ileus has manifested itself. The present treatment consists of maintaining fluid and nutritional balance plus instituting intestinal suction. The latter is a life saving measure in many cases and should be instituted early. The tube of preference for intestinal suction is a double tube[13] rather than a double lumen tube. Eight to ten feet of tubing will usually traverse the entire small intestinal tract. The tube should be placed into the duodenum under direct fluroscopic vision and then advanced at least two or three inches every hour until the lower ileum is reached. It should be added that this procedure is tedious and time consuming but can practically always be accomplished. Recovery is usually rapid and uneventful if proper treatment is used.

Acute gastric dilatation is closely related to ileus and is treated by gastric lavage and by continuous suction if the condition recurs. Often gastric suction is necessary in addition to small bowel decompression. Local heat to the abdomen is of no proven value in stimulating peristaltic activity or in any way decreasing distention.

Peritonitis is a serious complication and requires judicious treatment. Acute bacterial peritonitis should be treated as described above and with a few additional measures. Sulfonamides should be administered parenterally in large doses. The patient should be well sedated, in fact, almost to the stage of somnolence. It is imperative to maintain proper fluid and nutritional balance. Frequent small whole blood transfusions are indicated. The semi-Fowler's position is the most desirable. If the patient recovers, localization as a rule takes place. The most common site of localization is in the pelvis. Pelvic abscesses in the female should be drained through the posterior vaginal fornix. Drainage in the male should be through the rectum. Other abscesses should likewise be drained extraperitoneally. An exploratory aspiration should not be performed when a subdiaphragmatic abscess is suspected because of the danger of contaminating the pleural cavities and spreading the infection to uninvolved portions of the peritoneal cavity. Simple, early postoperative intestinal obstruction is usually caused by some inflammatory process or plastic adhesions. Practically all of the inflammatory ones and a large percentage of the early adhesive ones will be completely relieved by intestinal suction. Very little time will be lost if the above treatment does not relieve the symptoms. Patients should be followed with frequent *x*-rays to help determine whether a closed loop exists. If the above treatment does not relieve the symptoms, it should be assumed that a closed loop exists and an exploration should be performed through another incision. It is poor judgment to believe that the risk of a few hours of properly directed conservative treatment is too great. Intestinal decompression by continuous suction, as a rule, simplifies operations for intestinal obstruction. Careful surgery, including peritonealizing raw surfaces, will eliminate many cases of postoperative intestinal obstruction. The above may not be the treatment of choice in intestinal obstruction occurring several weeks postoperatively.

No discussion of postoperative treatment would be complete without some

mention of dicumarol and its clinical evaluation. A great deal has been said and written concerning the use of dicumarol in the prevention and treatment of thrombophlebitis and phlebothrombosis. It is thought that some bichemical or physiochemical change takes place in the blood on or about the sixth postoperative day causing increased blood clotting; however, venous stasis is the most logical etiological factor in the production of the thrombo-embolization. Phlebothrombosis and thrombophlebitis are serious complications and the consequences may be fatal. It is estimated that 1 per cent of major surgical cases develop pulmonary embolism, having its origin in the above mentioned conditions. Embolism is more common following phlebothrombosis than thrombophlebitis because the clot is not as firmly adherent to the vein wall, thus becoming more easily dislodged.[14] Before proceeding to the treatment of the venus complications, something should be said about their prevention. It is a proven fact that such complications are usually due to an improperly managed postoperative course. Until comparatively recently patients upon returning from the operating room were told to remain perfectly quiet in bed and were "snowed under," so to speak, with sedatives for three to seven days. All surgeons realize now that this was ill advised. It is realized that venous stasis and dehydration are important factors in the production of venous complications. It should be stated that thrombosis probably precedes any change in the vein wall.[15] After the thrombus forms secondary inflammatory changes occur. We must take active steps toward the elimination of the known etiological factors. Deep breathing and leg exercises are of indisputed value. However, this complication still occurs in some postoperative patients despite the usual preventative measures. Here dicumarol has come to our rescue. The writer's[16] experience has not been so wide, but from his observations and from the wide acclaim in the literature, it should be prescribed when trouble is to be expected. It is not without dangers and, therefore, should not be used indiscriminately. It is indicated in patients who have had extensive pelvic operations, operations in which there was probable trauma to large veins, cesarean sections, patients who have had previous venous or allied complications and following any other surgical procedure which might predispose to such complications.[17] The drug should be started on the third postoperative day using an initial oral dose of 200 mg. followed by 100 mg. the next day, but no more dicumarol should be given until after forty-eight hours, at which time an additional 100 mg. daily may be administered until the prothrombin time reaches 60 per cent of normal. The desired prothrombin time is 60 to 30 per cent of normal. It must be emphasized that daily prothrombin determination must be performed and the drug given accordingly. Prothrombin time should remain elevated until the patient becomes ambulatory and then it should be allowed to return gradually to normal.

Therapeutically dicumarol should be given in the same manner, observing the above mentioned precautions. When an unexplained fever develops during the postoperative course thrombophlebitis or phlebothrombosis should be suspected and a diligent search made for its detection. Treatment should be instituted immediately upon making the diagnosis. The course of the complication may be greatly shortened and the patient be made more comfortable. Dicumarol is, of course, to be used only as an adjunct to other therapeutic measures known to be of value. The only serious untoward reaction reported from its use is a bleeding tendency, which is chiefly into the operative wound. This is not common and does not present a major problem. The bleeding tendency which develops in a small percentage of cases can be effectively combatted by fresh whole blood transfusions and accord-

ing to some recent writers, by the use of large doses of vitamin K.[18,19]

Wound disruption is a serious but uncommon complication of the postoperative course. Prophylactic measures are of utmost importance. Dietary deficiencies should be corrected to the greatest possible extent preoperatively. Special attention should be given to the replacement of proteins and vitamin C. Vitamin A is also thought to be a factor in the proper healing and tensile strength of wounds. Often it is not possible to postpone operations until the various deficiencies have been corrected, and in such cases special postoperative measures are indicated. Nitrogen balance may be properly maintained and vitamin deficiencies corrected by parenteral feedings. Other important factors which may be responsible for the production of eviscerations are: (1) hematomas in the wound; (2) wound infection; (3) sensitivity to catgut;[20] (4) use of continuous suturing; (5) abdominal distention; (6) persistent coughing or vomiting, and (7) improper approximation of tissues.

When wound disruption occurs it is truly a surgical emergency. The patient should be immediately taken to the operating room and a secondary closure performed. In many cases it can be satisfactorily accomplished under local anesthesia. The closure of choice is accomplished by the use of interrupted through-and-through non-absorbable sutures. The sutures should be placed close together.

Urinary tract complications are too commonly seen. In all probability most of these could be prevented by the proper use of the catheter. According to some recent investigations in the Navy, a great deal of urinary retention is psychic in origin and may be prevented by conscientious and properly trained hospital personnel.[21] Any postoperative patient who does not void every six hours or who voids only small quantities frequently should be catheterized. Overdistention of the bladder further depresses its ability to empty and opens the way for infection.[22] After infection is present it may be rather difficult to control, despite the most judicious treatment. Sulfonamides and other urinary antiseptics are of value.

SUMMARY AND CONCLUSIONS

An attempt has been made to correlate and summarize the newer postoperative advances into a readable thesis. The writer is not presenting these newer trends as original ideas, for a large percentage of them have appeared elsewhere.

Great emphasis has been placed upon the importance of nutrition and fluid balance in the smooth convalescence of postoperative patients. The treatment must be individualized to meet the presenting needs. The body metabolism should be disturbed as little as possible. Protein intake should receive precedence.

Emphasis should be placed upon the free use of blood and blood substitutes. Too often the amounts given are inadequate.

Unfortunately, since the advent of sulfonamides, blood plasma and many other additions to our armamentarium, the tendency is to forget many minor details which in a great part would prevent many of the common postoperative complications. Proper management of the postoperative course is at least as important as surgical technic. The frequent and early use of intestinal suction will go a long way toward shortening the convalescent period in many cases and is actually a life saving procedure in some.

Dicumarol, while still in the experimental stage, appears to have a promising future in the prevention and treatment of thrombo-embolization. It is presented as an adjunct to other therapeutic and preventative measures.

The author is greatly indebted to Drs. A. N. Collins, M. G. Gillespie and W. G. Strobel, Duluth, Minnesota, for assistance in the preparation of this paper.

REFERENCES

1. Report of the Committee on Convalescence and Rehabilitation of the National Research Council,

Dec. 17, 1943, and appeared in Bumed News Letter (Navy); 3: 1–11, 1944.
2. Cannon, Paul R. Protein metabolism and acquired immunity. *J. A. Diet. Ass.*, 20: 2, 1944.
3. Cutler, E. C. Problem and peritoneal drainage. *Am. J. Surg.*, 59: 1, 1944.
4. Kreig, Earl G. Control of postoperative pain—application of cold to operative site. *Am. J. Surg.*, 62: 114, 1943.
5. Hartzell, J. B., Winfield, J. and Irwin, J. L. Plasma, vitamin C and serum protein levels in wound disruption. *J. A. M. A.*, 116: 669, 1941.
6. Daughtry, D. C. The value of cod liver oil ointment in surgery. (To appear in Surgery.)
7. Hardin, P. C. Cod Liver oil therapy of wounds and burns. *South. Surg.*, 10: 301, 1941.
8. Stone, H. B., Owings, J. C. and Gey, G. O. Living grafts of thyroid and parathyroid glands. *Surg., Obst.*, 60: 390, 1935.
9. Richards, V. Sulfonamides in surgery. *Surgery*, 14; 308, 1943.
10. Crutcher, R. R., Rollin, A. D., Jr. and Billings, F. T. The effect of sulfanilamide, sulfathiazole and sulfadiazine. *Ann. Surg.*, 117: 677–685, 1943.
11. Golden, Benj. I. Absorption routes of sulfonilamide. *Am. J. Surg.*, 62: 235–241, 1943.
12. Gillespie, M. G. and Blumgren, J. E. Use of blood and blood substitutes in surgery. *Minnesota Med.*, 27: 106–109, 1944.
13. Johnston, C. G. Decompression in treatment of intestinal obstruction. *Surg., Gynec. & Obst.*, 70: 365–369, 1940.
14. Evans, James A. Problems of postoperative thrombophlebitis and pulmonary embolism. *Connecticut State M. J.*, 8: 71, 1944.
15. Potts, W. J. and Smith, S. Pulmonary embolism. *Arch. Surg.*, 46: 27, 1943.
16. Daughtry, D. C. Dicumarol in surgery. *Am. J. Surg.*, 68: 80, 1945.
17. Barker, N. W. The use of dicumarol in surgery. *Minnesota Med.*, 27: 102, 1944.
18. Lehmann, Jorgen. Thrombosis—treatment and prevention using dicoumarin. *Lancet*, 1; 611, 1943.
19. Davidson, C. S. and McDonald, Harriet. A critical study of the action of dicoumarin. *Am. J. M. Sc.*, 205: 24, 1943.
20. Kaissel, C. J., Kesten, B. M. and Cimiotti, J. G. The relation of catgut sensitivity to wound healing. *Surg., Gynec. & Obst.*, 66; 628, 1938.
21. McLaughlin, C. W. and Brown, J. R. Postoperative urinary retention. *Naval Med. Bull.*, 42: 1025, 1944.
22. Ilgenfritz, H. C., Penick, R. M. and Maes, Urban. Urinary Tract Infection. Synopsis of the Preparation and After-care of Surgical Patients. St. Louis, 1941. C. V. Mosby Company.

BICIPITAL TENDOVAGINITIS

MAJOR I. W. KAPLAN AND MAJOR B. L. HAWKINS
MEDICAL CORPS, ARMY OF THE UNITED STATES

BICIPITAL tendovaginitis is a frequent cause of disability in the "painful shoulder syndrome."

Tendovaginitis of the long head of the biceps muscle may be serous or fibrinous and it is usually considered to be the result of trauma, infection or a combination of both.

The long head of the biceps arises from the supraglenoid tubercle situated immediately above the glenoid rim, is continuous with the glenoid labrum, and tranverses the joint. Although it is intracapsular, it remains extrasynovial, as it receives a tubular sheath from the synovial membrane, which invests the tendon for a varying distance after it has left the capsule. This synovial sheath and the tendon are retained in the intertubercular sulcus (bicipital groove) by the transverse humeral ligament, a thickened part of the capsule which bridges the groove and is attached to both tubercles, and also by a fibrous prolongation from the tendon of the pectoralis major.

Schrager has pointed out that the vulnerability of the long head of the biceps muscle to both specific and non-specific infection is based on a number of factors. (1) *Anatomical:* The relative instability of the shoulder joint and constant movement of the tendon as it arches over the head of the humerus subjects it to injury and dislocation. (2) *Physiological:* The tendon is taxed beyond its physiological requirements by the many strenuous activities of the shoulder joint, and (3) *because of its vestigial nature,* constant friction and overuse, it falls prey to infection.

There is both statistical and experimental evidence to support the view that rapidly repeated muscular movements over a long period of time, particularly if the muscles involved are unaccustomed to such work, commonly causes tendovaginitis. In experimental animals, rapid, passive movements, continued over a period of several hours, caused fraying of the surface of the tendons and tendon sheaths, as well as edema and interstitial hemorrhage of the surrounding soft tissue. Acute tendovaginitis may be serous or fibrinous, the latter being called peritendinitis crepitans. In both types of acute tendovaginitis there is edema particularly in the areolar tissue of the outer part of the sheath and hyperemia with sparse infiltration by mononuclear cells. In acute fibrinous tendovaginitis or peritendinitis crepitans there are collections of fibrin throughout the inflamed sheath; but according to Howard not within it. Howard is of the opinion that fatigue rather than mechanical destruction of tissue is responsible for the lesion and supports his view with the observation that the involved tissue shows a diminution in glycogen, a rise in hydrogen ion in concentration, and the presence of lactic acid. Repeated attacks may lead to a chronic stenosing tendovaginitis.

The condition is most frequently seen in young male adults engaged in strenuous activities. The history is that of gradually increasing pain and stiffness of the shoulder joint. The pain may be generalized over the shoulder, often radiating up into the neck to the scapular region, anteriorly to the subcoracoid area, or down the arm to the forearm. The patient may complain of inability to carry out certain movements, especially abduction of the arm; of lifting heavy objects or other activities that tend to put the tendon on stretch; of pain at night which awakens him and forces him to find a more comfortable position. Pain on motion of the affected tendon is the

presenting symptom, while tenderness on pressure over the sheath of the tendon of the long head of the biceps is the most characteristic physical finding.

The condition must be differentiated from other lesions resulting from minor trauma. Muscular strain, ligamentous sprains, and acute traumatic synovitis are usually preceded by a single traumatic episode and are accompanied by pain and tenderness limited to the structure involved. Fractures of the greater tuberosity with little displacement, subacromial bursitis with calcification, arthritis of the acromioclavicular joint are common and must be ruled out by roentgenographic examination. Other conditions such as scaleneus anticus syndrome, and subacromial bursitis without calcification must be excluded by special examinations and often by infiltration with novocain into the painful area. The latter we have found to be a very valuable diagnostic aid.

TREATMENT

This condition responds readily to infiltration therapy with 1 per cent novocain and normal saline. This type of treatment is simple, inexpensive, readily available, and may be used as an office procedure.

The long head of the biceps tendon may be marked on the surface by a line beginning at the acromial process and just lateral to the coracoid process extending downward approximately three inches and about one-half inch lateral to the medial edge of the deltoid muscle. When pressure is made over this area, if the condition of a bicipital tendovaginitis is present, it causes the patient to wince with pain. Having marked the location of the tendon, the skin on this line is infiltrated with 1 per cent novocain in three places by making three wheals at the upper, middle, and lower end. The infiltration is carried down to the cortex of the bone. The point of the needle is then withdrawn 2 or 3 mm. and about 10 cc. of novocain are injected in and about the tendon and tendon sheath. This is followed by the injection of about 15 cc. of normal saline. This procedure is repeated through each wheal on the line marking the position of the tendon. Often during the procedure the patient will complain of severe pain. This is probably caused by the distention of the tendon sheath with the novocain or saline. The treatment, if applied correctly, gives immediate relief, only to be followed by an increase in symptoms for the first twenty-four to forty-eight hours. The patient is encouraged to get under the shower and limber up the shoulder with gentle exercises for the first few days. Usually after four days there is complete relief of pain. Occasionally it is necessary to repeat the procedure if symptoms persist.

In the past thirteen months on an orthopedic service of a station hospital, fourteen cases of bicipital tendovaginitis were seen. The average age of the patient was thirty years. Only five gave a history of trauma. The duration of symptoms varied from twenty-four hours to eight years. The one case of eight years' duration was of the chronic stenosing type. The right shoulder was involved thirteen times, the left once. There were no bilateral cases in the group. Two patients of the group required more than one treatment. One had three and obtained about 50 per cent relief, the other had two and had no relief. This was the chronic stenosing case and it was realized from the start that the chances of success were poor; nevertheless, treatment was given to see what effect it would have. Of the patients treated 85.7 per cent responded favorably. If the one case of chronic stenosing type is not included the percentage is increased to 92.8 per cent. The average time of disappearance of symptoms was four days. No recurrences were observed; however, it is only fair to state that the average time of observation was somewhat less than three months. One case was observed nine months. Due to the movements of troops it was almost impossible to get an accurate follow up.

COMMENT

The mechanism which precipitates the acute symptoms as well as the general etiology remains entirely obscure. Infection and trauma are mentioned most frequently as possibilities. The fact that thirteen out of fourteen cases occurred in the right shoulder leads us to believe that the additional trauma of use in right-handed individuals might be an important factor.

CONCLUSION

1. Bicipital tendovaginitis in young male adults engaged in strenuous activities is a relatively common condition and deserves more consideration in the differential diagnosis in the clinical entity that has become designated as the "painful shoulder syndrome."

2. Trauma and infection are mentioned as possible etiological factors.

3. The right shoulder is most commonly affected in right-handed individuals suggesting that the additional trauma of use may be a factor in the etiology.

4. The average age in our group of cases was thirty years.

5. Infiltration therapy has given excellent results in our series of cases presented.

6. Treatment is accompanied by relief of pain and restoration of a full range of motion at the shoulder joint.

REFERENCES

1. Beesley and Johnson. Manual of Surgical Anatomy. 5th ed. London, 1939. Oxford Medical Publications.
2. Cooper, William. Calcareous tendinitis in the meta-carpo-phalangeal region. *J. Bone & Joint Surg.*, 24: 114–122, 1942.
3. Howard, N. J. Peritendinitis crepitans. *J. Bone & Joint Surg.*, 19: 447, 1937.
4. Inman, Verne T., Saunders, M. and Abbot, Leroy C. Observations on the function of the shoulder joint. *J. Bone & Joint Surg.*, 26: 1–30, 1944.
5. Kaplan, I. W. and Hawkins, B. L. Infiltration therapy of subacromial bursitis with calcification. *New Orleans M. & S. J.*, in press.
6. Lapidus, Paul W. Infiltration therapy in acute tendinitis with calcification. *Surg., Gynec. & Obst.*, 76: 715–725, 1943.
7. McLaughlin, Harrison L. Lesions of the musculotendinous cuff of the shoulder. *J. Bone & Joint Surg.*, 25: 31–51, 1944.
8. Moritz, Allan Richard. The Pathology of Trauma. Philadelphia, 1942. Lea & Febeger.
9. Oppenheimer, Albert. Arthritis of the acromioclavicular joint. *J. Bone & Joint Surg.*, 25: 867–870, 1943.
10. Schrager, V. L. Syphilis of the Tendon of the long head of the biceps muscle and of the olecranon bursa. *Arch. Surg.*, 48: 423, 1944.

Case Reports

ACUTE SUPPURATIVE APPENDICITIS WITH ABSCESS FORMATION AND SUBSEQUENT PERFORATION OF THE ANTERIOR ABDOMINAL WALL

LOUIS J. GARIEPY, M.D. AND PAUL G. HENLEY, M.D.
Senior Surgeon, Mount Carmel Mercy Hospital — Senior Resident, Mount Carmel Mercy Hospital
DETROIT, MICHIGAN

ACUTE suppurative appendicitis with rupture, abscess formation, and subsequent perforation of the abdominal wall was mentioned in textbooks on surgery written in the latter part of the nineteenth and the beginning of the twentieth centuries.[1,2] Many present day authors do not mention the possibility of perforation through the abdominal wall as a complication of appendiceal abscess.[3,4,5] The volume of literature pertaining to the appendix is so vast that it does not lie within the modest limits of this article to make a comprehensive review in order to state exactly the number of instances in which cases have been reported or the incidence of invasion of the anterior abdominal wall by appendiceal abscesses. A few cases have been reported in the last twenty years, and a discussion of phlegmons of the abdominal wall as a complication of acute appendicitis was presented by Argentine surgeons in 1940.[6] Cullen described a "progressively enlarging ulcer of the abdominal wall involving skin and fat, following drainage of an abdominal abscess apparently of appendiceal origin."[7]

The case here reported is the only one on record at Mount Carmel Mercy Hospital, Detroit, Michigan, where some 12,000 cases of appendicitis have been cared for in the past six years.

Abscess formation occurring with appendicitis is one of the most common and will probably remain one of the most common complications.[8,9,10] The prime purpose in presenting this case is not to record a rarity, but to emphasize the fact that such a condition may be encountered, even in present day general acceptance of early operation for appendicitis, and to point out that such complication of appendicitis should be included in the differential diagnosis of masses in the anterior abdominal wall.

CASE REPORT

A forty-six year old, white male entered the hospital complaining of a mass in the right lower quadrant.

Two weeks prior to admission, the patient developed an acute pain in the right costovertebral angle. One day later the pain moved anteriorly and downward, localizing just above and midway along Poupart's ligament. When the pain in the back was first experienced, the patient was nauseated, but did not vomit. The pain became less intense and the patient thought that it would be gone shortly. This expectation was not justified, but the patient still procrastinated.

He had been constipated since the onset of the pain. Three days prior to admission a mass appeared in the right inguinal region.

Physical examination revealed an acutely ill, well developed, well nourished, adult male whose mental attitude was markedly cloudy. Heart and lungs were negative. Examination of the abdomen revealed an obvious mass in the right lower quadrant, limits of which reached the midline up to the umbilicus and extended down the entire length of Poupart's ligament. (Fig. 1.) The mass was highly in-

FIG. 1. The skin marking above the fluctuating area is due to a hot water bottle burn before admittance to the hospital.

flamed. One area about two inches across and beginning one inch above and midway of Poupart's ligament showed necrosis of the epidermis. The center of this area was fluctuant. The liver and spleen were not palpable. Rectal examination revealed a packed content of hard feces. The extremities were normal. The temperature was 103°F., pulse 90 per minute and the blood pressure was 120 systolic and 70 diastolic.

Urine examination was normal. The blood showed 13,000 white blood cells, 69 per cent hemoglobin and a normal serology.

The patient was taken to the operating room, where a small stab wound was made over the area of fluctuation. Approximately eight ounces of bloody, purulent material with a colonic odor was obtained. Culture of the material revealed Escherichia coli. Exploration of the wound disclosed continuity with the abdominal cavity. A drain was inserted. The wound was irrigated twice daily with tyrothricin and inflammation and swelling receded rapidly. On the second postoperative day the patient's right lower extremity was noticeably enlarged and painful. Measurements were taken and the right thigh was found to be three and three-fourths inches larger than the left at the mid-thigh level. The external veins showed no signs of thrombosis or phlebitis. Ten days postoperatively the abscess had almost completely receded and the extremities were normal.

The patient was discharged from the hospital on the fourteenth postoperative day and was instructed to return in two weeks.

Upon readmission, the stab wound was found to be practically healed. The blood, urine and temperature were normal. Another operation was performed and the appendix was removed. It was found adherent to the anterior abdominal wall adjacent to the internal inguinal ring. The appendix measured 3 cm. in length and showed signs of distal necrosis. The pathological report was acute suppurative appendicitis. The patient made an uneventful recovery.

COMMENT

To be factually certain of the diagnosis, based on the finding of a mass in the right inguinal region, is rather difficult at times, Psoas abscess, lymphadenitis, hernia, granuloma inguinale, tumors, and other conditions must be considered. In the case reported, the pain began in the right costovertebral angle. This would suggest a psoas or perinephritic abscess. In all probability the pain in this region was due to encroachment upon the ilio-inguinal or iliohypogastric nerve. None of the classical symptoms of acute appendicitis were present except nausea. The enlargement of the limb, subsiding rather promptly and without untoward incident, reminds one that thrombophlebitis is another possible complication of a ruptured appendix with abscess formation.

Lewis and Firor[11] suggest that most appendiceal abscesses begin between the cecum and the anterior abdominal wall. This being the case, penetration of the abdominal wall could be a natural sequence. Another explanation of the chain of events in this case could be that the internal ring was dilated and the appendix might have been strangulated. This was suspected and at the time of operation an attempt was made to demonstrate this condition, but due to the dense adhesions in the region, which were not disturbed in the presence of infection, investigation was unsatisfactory. At the second operation, however, the appendix was found adjacent to the inguinal ring and it was released therefrom. Cases have been reported of appendicitis occurring in inguinal hernias. Waldman[12] reported three cases in which the appendix was found in the hernial sac. Winn[13] reported similar cases. A third possible factor could be the peritoneal reaction to the inflamed appendix. Such reaction might succeed in completely walling off the appendix from the abdominal cavity proper, making invasion of the adjacent abdominal wall the easier route for extension and rupture.

It may be of interest to note that Breslin,[14] in discussing gas bacillus infection of the abdominal wall in appendicitis, reported a case in which extension occurred to the left abdominal wall. In his case he considers the fact of rather unusual interest that the infection of the right rectus muscle was limited in the extension upward by one of the tendenous inscriptions and further

points out that the infection spread from the right rectus across the barrier of the linea alba to involve the left rectus muscle and the left abdominal wall, probably, he says, by way of the pyramidalis muscle. Thus it may be well to add the point in differential diagnosis concerning the anterior abdominal wall that there are cases of left-sided appendicitis and also the possibility of extension from a right-sided appendiceal abscess to invasion of the abdominal wall on the opposite side. The better supplied the surgeon is with the knowledge of instances of the unusual and the improbable, the better prepared he may be to find the correct solution when presented with the unexpected and the bizarre.

SUMMARY

A case of acute suppurative appendicitis with abscess formation and subsequent perforation of the anterior abdominal wall is presented.

Concerning a mass in the abdominal wall, particularly one in the right lower quadrant, differential diagnosis should include extension of an appendiceal abscess.

Cases similar to the one here reported have occurred but are comparatively rare at the present time.

The probable manner in which the abdominal wall was invaded is discussed.

REFERENCES

1. Ashhurst, John, Jr. International Encyclopedia of Surgery. Vol. 5, pp. 618–661. New York, 1884. William Wood & Co.
2. Bryant, Joseph D. and Buck, Albert H. American Practice of Surgery. Vol. 7, pp. 995–1039. New York, 1910. William Wood & Co.
3. Orr, T. G. Operations of General Surgery. P. 376. Philadelphia, 1944. W. B. Saunders Company.
4. Thorek, Max. Modern Surgical Technique. Pp. 1465–1482. New York, 1939. J. B. Lippincott Co.
5. Christopher, F. Textbook of Surgery. Pp. 1113–1127. Philadelphia, 1939. W. B. Saunders Company.
6. Jorge, J. M. and de Nicola, C. Phlegmons of abdominal wall as complication of appendicitis in acute process. *Bol. y trab., Acad. argent. de cir.*, 24: 163–168, 1940.
7. Cullen. Progressively enlarging ulcer of abdominal wall following drainage of abdominal abscess. *Surg., Gynec. & Obst.*, 38: 579, 1924.
8. Bailey, Hamilton. Emergency Surgery. Pp. 90–114. Baltimore, 1944. William & Wilkins Co.
9. Johnson, A. B. Surgical Diagnosis. Pp. 118–135. New York, 1911. D. Appleton & Co.
10. Hertzler, A. E. Surgical Pathology of the Gastrointestinal Tract. Pp. 240–272. Philadelphia, 1936. J. B. Lippincott Co.
11. Christopher, F. Op. cit., pp. 1113–1127.
12. Waldmann, V. F. *U. S. Na y Bull.*, 42: 440–442,
13. Winn, D. F. *Mil. Surgeon*, 63: 77–79, 1928.
14. Breslin, F. J. Gas bacillus infection of the abdominal wall in appendicitis. *Am. J. Surg.*, 49: 501–502, 1940.

POLYPS OF THE APPENDIX

LIEUT. COL. J. WILLIAM WHITE AND MAJOR RALPH C. ELLIS
MEDICAL CORPS, ARMY OF THE UNITED STATES

POLYPS of the gastrointestinal tract have received considerable attention in the surgical literature of recent years. However, polyps are rarely observed in the vermiform appendix. Only twenty-one cases have been reported.

Collins,[1] in 1932, collected seventeen cases and contributed the report of a similarly affected male patient aged seventy-six years. In 1942, Sanes and Patchin[2] called attention to two additional cases and reported one of their own.

The infrequency with which appendiceal polyps are encountered is attributed in part to the failure of pathologists to inspect carefully the lumina of appendix specimens.

Between January, 1941, and November, 1944, there were 898 appendices examined in this hospital. The subsequent case report illustrates the single instance in which a polyp was found and, in consequence, denotes an unparalleled incidence of 0.11 per cent.

Etiology. Records indicate that the sexes share the lesion equally. However, young adults, those in whom appendicitis is most frequent, are more often affected. In nineteen reports in which the age was given, fifteen patients were below and four above the age of forty years; the eldest was eighty years old.

The pathogenesis of polyps is unknown, but speculation suggests two possibilities: a familial polypoid hypertrophy of the mucosa and a reactive hyperplasia following prolonged inflammation. In those cases occurring early in life, sometimes beginning in childhood, there is a distinct tendency for polyps to occur in several descendents of the same lineage. The familial hypothesis seems to gain support also through the circumstance that appendiceal polyps are frequently associated with similar tissue changes elsewhere in the gastrointestinal tract, at sites involved in various members of successive generations. A negative family history, however, is not necessarily significant because relatives of the patient may, for the time being, be asymptomatic or their polyps, as is often the case, may be difficult to demonstrate.

Symptoms. Usually there are no symptoms directly attributable to an appendiceal polyp. Therefore, the diagnosis is difficult, or equivocal, before operation. Complaints are most often the result of associated disease, although they may occasionally arise from a morbid state initiated by the polyp. Analysis of fifteen cases revealed that acute appendicitis with perforation and subacute appendicitis each occurred once, chronic recurrent appendicitis occurred nine times and intussusception of the ileum and appendix occurred four times. Melena is an occasional complication. The patient referred to in the current case report had acute suppurative appendicitis and the polyp was considered an incidental finding, but there were signs and symptoms previously which, because of their subsequent improvement, were attributed to the polyp.

Pathology. Grossly, polyps of the appendix resemble those seen in other anatomic locations. They may be single or multiple. (In the case of Sanes and Patchin[2] there were two oppositely directed and overlapping polyps.) Ordinarily they are soft, pedunculated, or sessile tumors of the mucosa and submucosa in which the essential neoplastic element, composed of glandular epithelium, encompasses a supporting structure of fibrous tissue and its vascular components. They differ from fibromas, hemangiomas, and lipomas in that the latter are surrounded by normal mucosa. Some polyps are so large as to fill completely the appendiceal

lumen, much like a cast, and produce varying degrees of obstruction. More commonly, however, they measure from 0.5 to 3.7 cm. in length and the majority are intermediate to these measurements.

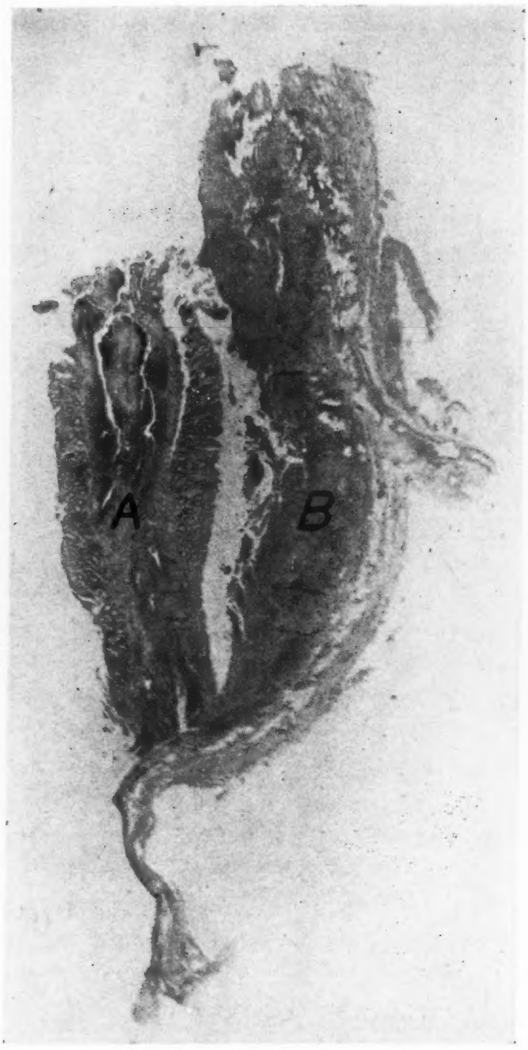


FIG. 1. Longitudinal section of polyp: A, polyp; B, wall of appendix.

Microscopically, appendiceal polyps are adenomatous in character. In some the submucosa is covered with apparently normal epithelium but there is usually a preponderance of mucus-secreting goblet cells or the tubules are enlarged as compared with the normal. In one case[2] there were venous thrombi and minute fecal concretions. Often there is metaplasia, epithelial proliferation, nuclear hyperchromatism and mitosis, signs of a precancerous change. True malignancy, however, has not been reported, although Sanes and Patchin[2] cite a case in which associated polyps of the colon were carcinomatous.

CASE REPORT

A white male army medical corps officer, aged thirty-three years, was admitted to the hospital, June 11, 1944, complaining of abdominal pain which had been present thirty-six hours.

The family history was irrelevant rather than negative in that the father suffered from diabetes mellitus. Although the patient's previous general health had been considered good, he had three to five well formed, normally appearing stools daily for as long as he could remember.

Abdominal colic was first experienced in 1933. It was accompanied by an urgency to defecate and was soon relieved by the evacuation of a large, black, loose, tarry stool. The following day bowel movements were normal in number, character, and consistency. One month later, the abdominal cramps recurred and persisted for the succeeding two or three consecutive weeks. During this interval large quantities of bright red blood were mixed with, or surrounded, the eight to ten daily evacuations. Occasionally mucus was observed in the stools. Proctosigmoidoscopic findings led to the diagnosis of ulcerative colitis. Parasites were not recovered. Relief was temporarily afforded by local treatments which were continued for approximately four months.

Between attacks, which recurred irregularly every six months, the stools, numbering three daily, were occasionally streaked with bright red or dark blood. Often the urge to defecate ended in the expulsion of large quantities of flatus only. Coarse foods, especially those with a high cellulose content, were avoided because they seemed to exaggerate the condition. While in the Pacific theater of operations, October, 1943, the symptoms became so severe as to necessitate hospitalization. Signoidoscopic examinations revealed numerous small ulcers of the sigmoid colon which, in two weeks, increased in size and depth. There was also a generalized, local hyperemia of the intestinal mucosa. Parasites were not recovered from the ulcers nor from the feces. These findings were

essentially verified at an army general hospital in the United States in January, 1944.

Interval studies were made at this hospital on May 10, 1944. There was slight abdominal tenderness more evident in the right lower quadrant, particularly at McBurney's point, and, to a lesser degree, along the course of the descending and sigmoid colon. The blood count, urinary findings and Kahn reaction were normal. *X*-ray study after an opaque enema revealed complete filling of the large bowel and terminal ileum. The appendix was not visualized. There was increased segmentation, attributed to irritability, of the lower descending and sigmoid colon. The postevacuation film showed approximately 10 per cent of the contrast medium remaining in the large bowel. Except for a slight hyperemia, the proctosigmoidoscopic findings, for a distance of 25 cm., were negative.

On June 9, 1944, thirty-six hours prior to his most recent hospitalization, the patient was wakened by generalized, colicky abdominal pain. About four hours later nausea and vomiting occurred. By the following noon the pain had localized rather diffusely in the right lower abdominal quadrant. The pain then became more acute and constant; it did not radiate and it was exaggerated by walking.

The abdomen was generally tender, especially in the right lower quadrant; rebound tenderness was marked and the psoas sign was positive. The urine and blood pictures were normal. Repeated blood counts revealed between 7,000 and 8,000 leukocytes with an average of 70 per cent neutrophiles. The blood pressure was 140/90, the temperature 100°F. and the pulse rate 104 per minute.

Fig. 2. Mucous surface of polyp: A, mucous glands; B, inflammatory infiltration. (× 200.)

A diagnosis of acute appendicitis was made and operation, through a right rectus incision, was performed immediately. The small intestine and colon were normal in appearance. There was free, straw-colored fluid in the peritoneal cavity. The appendix was red, edematous and partially covered with a fibrinous exudate; its lumen contained pus.

Pathological examination showed the appendix to be 8.5 cm. in length and 12 mm. in its maximum diameter. There was a fusiform swelling in the midportion covered by a plastic, fibrinous exudate. No perforation was found. The serosa of the distal portion was mottled with petechial hemorrhages. On cross section, the wall appeared slightly thickened and quite hemorrhagic. At the proximal end of the appendix there was a finger-like, fleshy process, 9 by 2 mm. in size, attached to the mucosa and projecting distally into the lumen. It was soft

in consistency and had the gross appearance of a polyp. It partially obstructed the appendiceal channel.

Microscopic examination of sections made from the proximal end of the appendix showed the wall to be somewhat thickened, with heavy deposits of fat in the submucous tissue. Large numbers of polymorphonuclear leukocytes were seen throughout all tissue layers. Areas of hemorrhage were present in the mucosa which was markedly ulcerated and extensively replaced by necrotic inflammatory exudate. The polypoid mass observed grossly consisted of a fibrous stalk arising from the submucosa and covered by glandular epithelium. The fibrous stroma was densely infiltrated with lymphocytes and polymorphonuclear leukocytes. The epithelium of the surface was intact and showed many small, oval and elongated glands. The mucosal stroma contained many eosinophilic and neutrophilic polymorphonuclear leukocytes, as well as plasma cells. The distal end of the appendix wall was eccentrically thickened with a diffuse infiltration of polymorphonuclear and red blood cells. The mucosa was ulcerated except for a few small remnants. Diagnosis: Polyp of the appendix with secondary obstruction and acute ulcerative and purulent appendicitis.

Recovery from the operation followed a normal course. The patient was discharged from the hospital on the fourteenth postoperative day and returned to active military duty two weeks later.

Upon re-examination, October 19, 1944, the officer was in excellent physical condition. His weight had increased to its normal standard. There was no recurrence of cramps, diarrhea, or melena. The stools, which numbered three daily, were normal in form, color, and consistency. Coarse foods were eaten sparingly, but in greater quantity and variety than formerly. They did not induce discomfort as in the past. *X*-ray examination by a double contrast method failed to reveal a lesion in the colon. The evidence of colitis in the descending and sigmoid colon, shown by examination on May 10, 1944, had disappeared. Proctosigmoidoscopic examination, November 3, 1944, in which the sigmoidoscope was passed 25 cm. and the mucosa visualized for an additional 6 cm., revealed nothing abnormal.

COMMENT

A higher incidence of appendiceal polyps would be revealed if all removed appendices were more carefully examined. To the twenty-one cases previously reported in the literature another rather typical example is added.

Polyps, except for melena, are usually asymptomatic and, therefore, difficult of diagnosis. *X*-ray or proctosigmoidoscopic evidence of polyps elsewhere in the gastrointestinal tract may suggest a similar lesion in the appendix, but single and isolated polyps do not produce clearly defined filling defects. It is the practice of roentgenologists, therefore, to use double contrast media. A negative family history is of no importance; and one that is positive affords but vague testimony upon which to base confidence.

In retrospect, the polyp under particular consideration figuratively cried out for recognition. Its site, although indefinitely localized, might have been suspected. The recurrent, colicky, abdominal pain marked the small bowel or the appendix as its source. The tenderness in the right lower quadrant, more acute at McBurney's point, during paroxysms and in the course of free intervals should have focused attention principally upon the appendix. Non-visualization of the latter viscus by *x*-ray examination, although an inconstant diagnostic factor, was significant because the appendiceal lumen was occluded by the polyp. Recurrent, unexplained melena should have suggested the possibility, if not the probability, of a polypoid lesion somewhere in the intestinal tract. Nevertheless, were it not for the superimposed acute suppurative process, the diagnosis would not have been made.

A more fortunate aspect is that the associated conditions or complications require surgical exploration and almost universally point to the appendix as the offending organ. An obstructing or inflamed polyp conceivably might simulate, or actually initiate an attack of acute ap-

pendicitis. Whether such circumstance prevailed in the above case is conjectural, but the polyp and the appendix showed identical degrees of inflammation and the lumen was obstructed.

It is interesting to speculate concerning the pre-existing diarrhea and ulcerative colitis, both of which were relieved after the appendix was removed. Did the polyp disturb the appendix sufficiently to make of it a trigger mechanism through which the colon was stimulated into spastic contractions intermittently? And was the diarrhea sufficiently irritating to produce inflammation and ulceration which, in turn, resulted in a vicious cycle? The appendix has been known to induce irritability of the colon; and prolonged nonparasitic diarrhea has been considered a cause of inflammation and ulceration of the rectosigmoid. The relief of symptoms, the demonstrable colonic improvement and the general well being of the patient since operation warrant the conclusion that there was a polyp-appendix-colon syndrome in the case proximately reported.

REFERENCES

1. COLLINS, D. C. Polyps of the vermiform appendix. *Surg. Clin. North America*, 12: 1063–1067, 1932.
2. SANES, S. and PATCHIN, D. F. Polyposis of the appendix. *Arch. Surg.*, 44: 912–917, 1942.

CYSTS or abscesses connected with the bladder are found in the hypogastrium, originating from the urachus. Urine discharges from the umbilicus if the urachus is fully open. Those posterior to the bladder may arise from the prostate or seminal vesicles. Dermoid or hydatid cysts may rarely involve the bladder wall, encroach upon the retrovesical pouch and should be excised.

From "Principles and Practice of Surgery" by W. Wayne Babcock (Lea & Febiger).

BENIGN TUMORS OF THE DUODENUM*

BURTON P. HOFFMAN, M.D. AND DAVID M. GRAYZEL, M.D.
BROOKLYN, NEW YORK

NEOPLASMS of the small intestine make up a small but important percentage of gastrointestinal tumors.

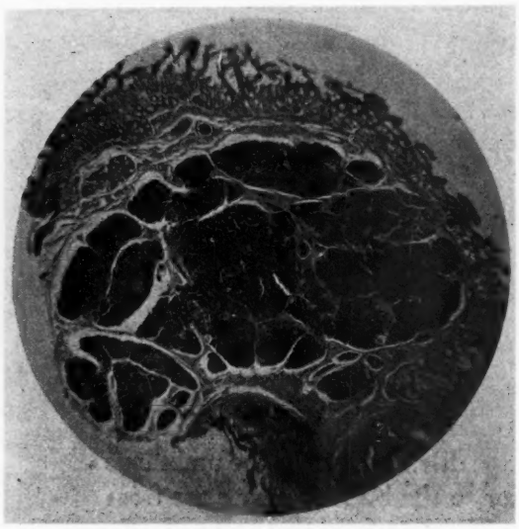


FIG. 1. Case III. Microphotograph showing pancreatic rest in duodenum; hematoxylin and eosin × 50.

It is difficult to understand how this major portion of the digestive tube, lying between the stomach and the large intestine and rectum, sites of predilection for neoplasia, should be so spared. It is our intent in this communication to consider mainly benign lesions that occur in the duodenum.

In reviewing 64,300 surgical specimens removed at operation from 1929 to 1945 and 4,480 autopsies performed from 1922 to 1945, we found fifty-eight tumors in the small intestine of which thirty-three or 56.9 per cent were benign, and twenty-five or 43.1 per cent were malignant. Of the benign tumors, fourteen were located in the duodenum, eight in the jejunum, and eleven in the ileum; of the malignant tumors, four were in the duodenum, six in the jejunum and eleven in the ileum. In four cases, the location of the tumor was not specified.

Eighteen out of fifty-five or 26.4 per cent of all tumors were located in the duodenum. Of the benign tumors, fourteen out of thirty-three or 42.4 per cent were in the duodenum and of the malignant tumors, four out of twenty-five or 16 per cent were at this site. These data are tabulated in Table 1.

TABLE 1

Lesion	Duodenum		Jejunum	Ileum	Small Intestine	Total	
	No.	Per Cent				No.	Per Cent
Benign...	14	42.4	8	11	..	33	56.9
Malignant...	4	16.0	6	11	4	25	43.1
Total..	18	26.4	14	22	4	58	100

CASE REPORTS

CASE I. J. S., a sixty-six year old white male was admitted to the Jewish Hospital of Brooklyn, February 18, 1927, dyspneic and acutely ill with the past history of right upper quadrant pain and jaundice on several occasions. He died soon after admission.

At necropsy, there was chronic cholecystitis, cholelithiasis with a calculus impacted in the common bile duct, and acute hepatitis. As an incidental finding, in the duodenal wall adjacent to the ampulla of Vater there was a firm nodule measuring 2 mm. in diameter. This nodule protruded from beneath the mucosa and on cut surface was grey white.

Diagnosis: Fibroma in duodenum.

CASE II. M. S., a fifty-five year old white female, underwent resection of a portion of the transverse colon for annular carcinoma ten years prior to admission. She entered the hospital on May 14, 1934, complaining of lower abdominal pain. At operation stenosis of the

* From the Department of Laboratories, Jewish Hospital of Brooklyn.

colon was found and ileosigmoidostomy was performed using a Murphy button. She died two days postoperatively.

Fig. 2. Case iv. Microphotograph showing gastric rest in duodenum; hematoxylin and eosin × 50.

At necropsy, generalized peritonitis and a cauliflower carcinoma of the sigmoid were found. Projecting from the duodenal mucosa, there was a small firm polyp which on cut section was finely lobulated.

Microscopic: The mucosa appeared intact. Within the submucosa and muscular coats, there were islands of pancreatic acini and ducts widely separated by bands of smooth muscle and dense fibrous connective tissue.

Diagnosis: Aberrant pancreatic tissue in duodenum.

Case iii. S. G., a twenty-three year old white male, was admitted to the Jewish Hospital of Brooklyn with a twenty-four hour history of headache and backache, fever, drowsiness, and vomiting. There was neck rigidity and a positive Kernig sign. Meningococci were cultured from the spinal fluid. He died soon after admission.

At necropsy, there was a purulent meningitis and focal pneumonia. In the second portion of the duodenum, there was a firm nodule measuring 5 mm. in diameter. This projected from beneath the mucosa and on cut section was lobulated.

Microscopic: Preparation from the nodule showed normal mucosa at one end. In the deeper portions of the muscular coat there were islands of pancreatic tissue. The acini and ducts were well demarcated and the lobules were separated by loose, somewhat edematous connective tissue septa.

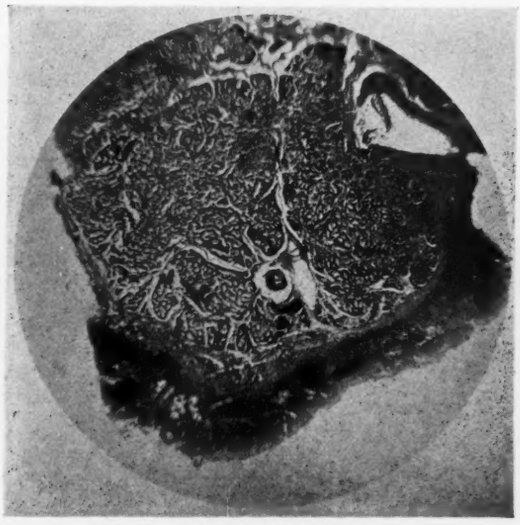


Fig. 3. Case vi. Microphotograph showing papillary adenoma in duodenum; hematoxylin and eosin × 50.

Diagnosis: Aberrant pancreatic tissue in duodenum.

Case iv. H. K., a seventy-nine year old white male, was admitted to the Jewish Hospital of Brooklyn with a three-day history of generalized abdominal pain. *X*-rays one year prior to admission showed pyloric stenosis. On admission, the patient was in shock, his abdomen was rigid, and he died one day after admission.

At necropsy, there was a perforated duodenal ulcer with generalized peritonitis, bronchitis and focal pneumonia. Three cm. distal to the papilla of Vater there was a flat, well circumscribed nodule measuring 1.3 by 1.0 cm. It was pale yellow and freely movable beneath the mucosa. On cut section, the surfaces were smooth and grey pink.

Microscopic: Normal duodenal mucosa was noted at one end. Beneath the lamina propria there was a well defined muscularis mucosae. Immediately subjacent to this there were numerous branching tubular structures lined by tall columnar cells whose cytoplasm was abundant and stained pale. The nuclei were vesicular and were basally placed. These resembled gastric glands and they extended into the muscular coats.

Diagnosis: Aberrant gastric tissue in duodenum.

Case v. R. M., a seventeen year old white

female, was admitted to the Jewish Hospital of Brooklyn on January 10, 1939, in an unconscious and moribund state. For twenty-four hours prior to admission there had been swelling and ecchymosis about the left eye with exophthalmos. She died soon after admission.

FIG. 4. Case X. Microphotograph showing lipoma of duodenum. Note attenuated mucosa and groups of Brunner's glands; hematoxylin and eosin × 10.

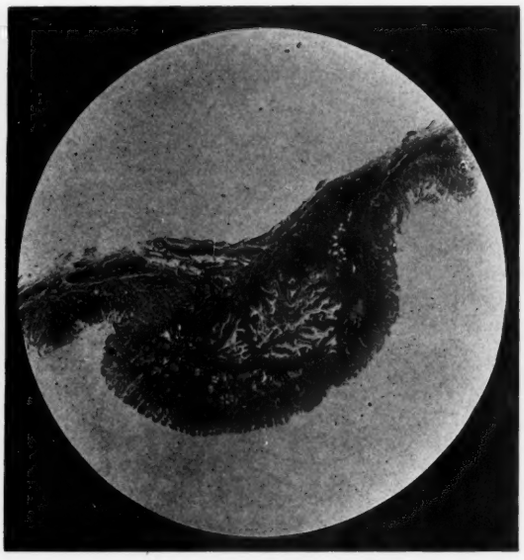


FIG. 5. Case XII. Microphotograph showing papillary adenoma of duodenum; hematoxylin and eosin × 10.

At necropsy, there was a cellulitis of the left orbit with exophthalmos, acute glomerulonephritis, and acute meningo-encephalitis. As an incidental finding there was a nodule projecting from beneath the mucosa of the duodenum. This measured 0.8 cm. in greatest diameter and was freely movable within the wall.

Microscopic: The duodenal mucosa was well preserved and beneath the muscularis mucosae Brunner's glands were seen. Beneath this there were islands of well formed pancreatic acini and ducts. These were separated into lobules by bands of fibrous connective tissue.

Diagnosis: Aberrant pancreatic tissue in duodenum.

CASE VI. N. F., a seventy-two year old white male, entered the hospital with the complaints of generalized bone pain, back pain, and constipation of five weeks' duration. Physical examination was negative except for a fractured left clavicle and two fractured ribs. He died seventeen days after admission with the clinical impression of multiple myeloma.

At necropsy, there was a hypernephroma of the left kidney with metastases to the skeleton, liver, right adrenal gland, esophagus and heart. Projecting from the duodenal mucosa 1.5 cm. distal to the pylorus, there was a well circumscribed nodule measuring 4 mm. in diameter. The cut surface was yellow pink.

Microscopic: Only at one end was normal duodenal mucosa seen. Elsewhere, it was completely denuded and replaced by necrotic tissue. In the muscular coat there were numerous vascular stalks upon which tall columnar cells were mounted in one or more rows. Similar cells were also seen lining irregular lumina which contained various amounts of pale staining material. The nuclei were vesicular and round or oval. The stroma was everywhere scanty.

Diagnosis: Papillary adenoma in duodenum.

CASE VII. H. L., a fourteen month old white male infant, was admitted to the hospital on March 10, 1940, because of physical and mental retardation. He died one month after admission during an attack of tonsillitis.

At necropsy, left subdural hemorrhage, atelectasis and emphysema, and focal pneumonia were found. Projecting from the mucosa of the duodenum there was a firm freely movable polyp measuring 1.2 cm. in diameter.

Diagnosis: Adenomatous polyp in duodenum.

CASE VIII. E. B., an eighty-eight year old white male, a cardiac of several years' duration, was admitted to the hospital on April 3, 1941, in congestive failure. He did not respond to therapy and died on the fourth hospital day.

At necropsy, there was bilateral focal pneumonia, generalized arteriosclerosis with particular involvement of the coronary arteries, and weight loss. A firm rectal mass was palpated. The patient died after a three week hospital stay.

Fig. 6. Case xiii. Microphotograph showing lymphangioma in duodenum; hematoxylin and eosin × 10.

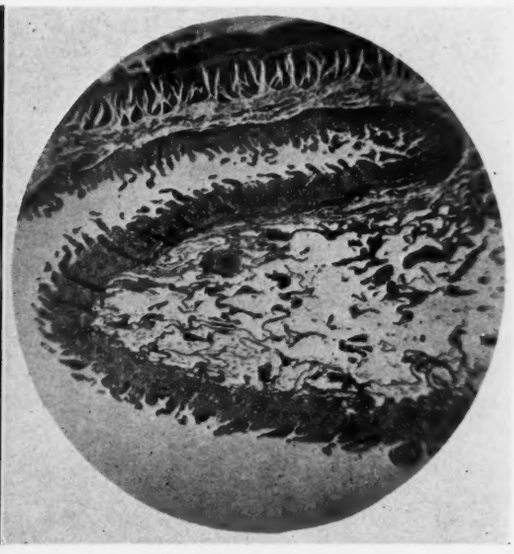


Fig. 7. Case xiii. Same as Figure 6. Note the loose arrangement of endothelial lined channels; hematoxylin and eosin × 50.

and with coronary occlusion and myofibrosis cordis.

In the duodenum, 12 cm. distal to the pylorus, there was a firm flat lobulated mass measuring 2.0 by 2.0 by 0.3 cm. This was attached to the mucosa by a wide pedicle and was freely movable. On cut section, the surfaces were grey pink.

Diagnosis: Adenomatous polyp in duodenum.

Case ix. J. W., a sixty-nine year old white male was admitted to the Jewish Hospital of Brooklyn on April 11, 1942, a year after he was found to have chronic myelogenous leukemia. He died on the day of admission.

At necropsy, there was leukemic myelosis involving the bone marrow, spleen, adrenal glands, left testis, and lymph nodes. Within the wall of the duodenum there was an elevated, firm, yellow brown nodule measuring 1.1 cm. in diameter. This projected from beneath the mucosa into the lumen, and on cut section was yellow brown.

Microscopic: The nodule consisted of pancreatic tissue undergoing autolytic changes.

Diagnosis: Aberrant pancreatic tissue in duodenum.

Case x. A. P., a sixty-seven year old white female, was admitted to the hospital on September 8, 1942, with a six-month history of intermittent diarrhea, tarry and bloody stools,

At necropsy, there was adenocarcinoma in the rectum with metastases to the lungs, and cirrhosis of the liver with esophageal varices and splenomegaly. Extending into the lumen of the duodenum there was a spherical yellow mass. This was soft and attached by a narrow pedicle. It measured 1.2 cm. in diameter and on cut section was homogeneous yellow.

Microscopic: The mucosa was not unusual and Brunner's glands were seen in the submucosa. Within the submucosa there was a large circumscribed area composed of adipose tissue cells. This was surrounded by a band of dense connective tissue and was of polypoid configuration.

Diagnosis: Lipoma in duodenum.

Case xi. R. B., a forty year old white male, had a heart murmur from the age of fifteen. He developed subacute bacterial endocarditis in the latter part of 1941 and was admitted to the hospital in August, 1942. He died three months after admission.

At necropsy, there was thrombo-ulcerative endocarditis of the mitral valve and healed endocarditis of the mitral, aortic and tricuspid valves. There were focal pneumonia, infarcts in the spleen and kidneys, and focal embolic glomerulonephritis. In the duodenum, adjacent to the pylorus, there was a firm, raised,

grey white nodule. This measured 2.1 by 2.0 by 0.5 cm. and was finely lobulated.

Microscopic: There were islands of pancreatic acini and ducts within the muscular coat of the duodenum.

Diagnosis: Aberrant pancreatic tissue in duodenum.

Case XII. R. W., a two and one-half month old white male infant, was admitted to the hospital on July 1, 1944, because of cough and weight loss. While at the hospital he developed anorexia, bronchopneumonia, and had fatty stools. He died six weeks after admission.

At necropsy, there was cystic fibrosis of the pancreas, bronchitis, focal pneumonia, and atelectasis and emphysema. In the duodenum, surmounted upon mucosal folds, there were two polyps. These measured 4 and 2 mm. in diameter and were pink in color and attached to the posterior wall 4 and 5 cm. distal to the pyloric ring.

Microscopic: The polyps were broad based and covered by normal duodenal mucosa and submucosa bearing Brunner's glands. The pedicles and stroma were composed of dense fibrous connective tissue and contained irregular sized and shaped gland-like lumina lined by tall columnar cells with basal nuclei and foamy granular cytoplasm.

Diagnosis: Adenomatous polyps in duodenum.

Case XIII. H. N., a seventy-two year old white male with chronic pulmonary disease of many years standing, was admitted to the hospital on August 18, 1944, with the chief complaint of dyspnea. A right pneumothorax was present which was relieved by decompression. He died suddenly on the sixth hospital day.

At necropsy, there was bilateral healed pulmonary tuberculosis, bilateral bronchiectasis, and focal pneumonia. Attached to the duodenal mucosa by a broad base 2 cm. distal to the papilla of Vater, there was a pink yellow polyp measuring 2.1 by 1.0 cm.

Microscopic: The mucosa and submucosa were not unusual. At one site they were outpocketed in polypoid fashion. There were numerous Brunner's glands throughout the submucosa, both in normal duodenum and in the polyp. The polyp consisted of a loose, irregular network of delicate empty vascular spaces of various sizes lined by flat endothelium.

Diagnosis: Lymphangioma in duodenum.

Case XIV. A. H., a fifty-four year old white female, underwent cholecystostomy and then cholecystectomy at another hospital for cholecystitis and cholelithiasis. She was admitted to the hospital on January 19, 1945, for jaundice. At operation stricture of the common duct at the ampullary region was found. Several centimeters removed from the papilla of Vater, within the wall of the duodenum, there was a yellow gray nodule measuring 1.5 cm. in diameter. This was removed with a portion of duodenal wall.

Microscopic: The nodule consisted of pancreatic acini and ducts.

Diagnosis: Aberrant pancreatic tissue in duodenum.

COMMENTS

The occurrence of benign tumors in the small intestine was once thought to be exceedingly rare. Up to 1917, there were 118 cases reported in the literature. King[1] reviewed these and added one of his own, making the total 119. Raiford,[2] in his exhaustive study of 11,500 autopsies and 45,000 surgical specimens at the Johns Hopkins Hospital, found only eighty-eight neoplasms of all types in the small intestine. Morrison[3] reviewed 2,434 autopsies and 10,705 biopsies at the Queens Hospital, Belfast, and was able to collect only twenty-one primary tumors of the small intestine. Rankin and Newell[4] reported thirty-five benign tumors of the small intestine from the Mayo Clinic.

Ewing[5] states that 3 per cent of all intestinal malignancies occur in the small intestine. In Raiford's series the small intestinal tumors constituted 8.9 per cent of all the gastrointestinal tumors. Of all the benign growths 23.8 per cent were in the small intestine and of all the malignant growths only 4.9 per cent.

In King's series of benign tumors of the small intestine, five out of 119 or 4.7 per cent were in the duodenum. In Raiford's study, thirteen out of fifty or 26 per cent were in the duodenum. In Rankin and Newell's series, fourteen out of thirty-five or 40 per cent were duodenal. Morrison found only thirteen benign tumors in the

small intestine of which one or 7.7 per cent was in the duodenum. He did not, however, include in his series heterotopic nodules, which the others did. Of these there were three, which would bring his percentage up to 25 per cent. A summary of these and our findings is tabulated in Table II.

TABLE II

	Tumors of Small Intestine					Tumors in Duodenum			
	Total	Benign		Malignant		Benign		Malignant	
		No.	Per Cent	No.	Per Cent	No.	Per Cent	No.	Per Cent
Hoffman and Grayzel	58	33	56.9	28	43.1	14	42.4	4	16.0
Raiford	88	50	57.8	35	42.2	13	26.0	8	21.1
Morrison	21	13	61.9	9	38.1	1	7.7	1	11.1
King	..	119	100	..	....	5	4.7		
Rankin and Newell	..	35	100	..	....	14	40.0		

The commoner types of benign duodenal growths according to Bockus[6] are the adenoma, the myoma, the lipoma, and the fibroma. Golden[7] collected seventeen cases from the literature and added two of his own. These included twelve adenomas (five of Brunner's glands), three myomas, a hemangioma, a fibroadenoma, a calcified fibromyoma, and a lymphangio-endothelioma. Balfour and Henderson[8] reported three adenomas, two myomas, and a hemangioma. Among Raiford's cases were four adenomas, three lipomas, two nodules of heterotopic pancreatic tissue, a cystic tumor, an argentaffinoma, a hemangioma, and a fibroma. Rankin and Newell presented five adenomas (two of Brunner's glands), six myomas, two hemangiomas, and a cystadenoma. Neurogenic tumors occur in the duodenum as cited by Ransom and Kay[9] and King. The adenoma is the commonest benign tumor found. It may be of two types, the mucosal gland or the characteristic Brunner gland type. Jacobius,[10] in 1940, reviewed seventeen cases of Brunner's gland adenomas occurring in the duodenum reported in the literature and added one of his own, making the total eighteen.

In our series, there were four adenomas, six pancreatic rests, a fibroma, a lipoma, a gastric rest, and a lymphangioma. The various types of tumors found by us and others are tabulated in Table III.

Many duodenal tumors are asymptomatic and are discovered only incidentally at autopsy. Some may, however, cause symptoms and require surgical treatment. The common and presenting complaint is melena; in these cases a polypoid tumor with an ulcerated surface is usually found. Occasionally, the ulcer syndrome may be mimicked. Kellogg[11] reports a case of intussusception due to a Brunner gland adenoma in the duodenum. Such occurrences are infrequent because of the comparative fixation of the duodenum to the posterior abdominal wall. Obstructive symptoms may occur if the neoplasm is large enough to impinge upon the lumen.

TABLE III

	Total	Adenoma	Myoma	Pancreatic Rest	Brunner Gland Adenoma	Hemangioma	Lipoma	Fibroma	Cystic Tumor	Lymph Angioma	Fibroadenoma	Argentaffinoma	Gastric Rest	Fibromyoma
Hoffman and Grayzel	14	4	.....	6	.....	.....	1	1	.....	1	.....	.....	1	
Golden	19	7	3	.....	5	1	.....	.....	.....	1	1	.....	.....	1
Rankin and Newell	14	3	6	.....	2	2	.....	.....	1					
Raiford	13	4	.....	2	.....	1	3	1	1	.....	.....	1		
Balfour and Henderson	6	3	2	.....	.....	1								
Total	66	21	11	8	7	5	4	2	2	2	1	1	1	1
Percentage	100%	31.8%	16.7%	12.1%	10.6%	7.8%	6.6%	3.0%	3.0%	3.0%	1.5%	1.5%	1.5%	1.5%

The diagnosis of duodenal lesions, at best, is difficult. They should be considered in upper gastrointestinal hemorrhage in the absence of gastric tumor or peptic ulcer. High gastrointestinal obstruction, often sudden in onset, may be due to such a tumor. Often, the patient may complain only of vague upper abdominal distress.

Little is found on physical examination. The epigastrium may be tender or a mass may be palpated in this general region. If obstruction is present, the usual signs of obstruction are present.

There is one aid invaluable in reaching a diagnosis. By roentgen ray examination, it is possible to demonstrate, in a great percentage of cases, a duodenal filling defect. It is even possible, at times, to outline polypoid tumors. *X*-ray study is the only accurate method for diagnosis other than direct visualization.

SUMMARY

A review is presented of tumors of the small intestine together with a presentation of fourteen cases of benign tumors of the duodenum.

The tumors of various series are presented in tabular form.

A discussion of their occurrence, frequency, and symptomatology is likewise presented.

REFERENCES

1. King, E. L. Benign tumors of the small intestine with special reference of fibroma. *Surg., Gynec. & Obst.*, 25: 54–71, 1917.
2. Raiford, T. S. Tumors of the small intestine. *Arch. Surg.*, 25: 122–177; 321–355, 1932.
3. Morison, J. E. Tumors of small intestine. *Brit. J. Surg.*, 29: 139–153, 1941.
4. Rankin, F. W. and Newell, C. E. Benign tumors of the small intestine. A report of 24 cases. *Surg., Gynec. & Obst.*, 57: 501–507, 1933.
5. Ewing, James. Neoplastic Diseases. 4th ed. Philadelphia, 1940. W. B. Saunders Co.
6. Bockus, H. L. Gastro-Enterology. Vol. II. Philadelphia, 1944. W. B. Saunders Co.
7. Golden, Ross. Non-malignant tumors of the duodenum *Am. J. Roentgenol. & Rad. Therap.* 20: 405–413, 1928.
8. Balfour, D. C. and Henderson, E. F. Benign tumors of the duodenum. *Ann. Surg.*, 89: 30–35, 1929.
9. Ransom, H. K. and Kay, E. B. Abdominal neoplasms of neurogenic origin. *Ann. Surg.*, 112: 700–746, 1940.
10. Jacobius, H. L. Brunner gland adenoma found accidentally at autopsy. *J. Mt. Sinai Hosp.*, 7: 212–216, 1940.
11. Kellogg, E. L. Intussusception of duodenum caused by adenoma originating in Brunner's glands. *Med. J. & Rec.*, 134: 440–442, 1931.

MIXED BACTERIAL GANGRENE OF AN EXTREMITY TREATED WITH PENICILLIN AND SULFADIAZINE

BERNARD N. E. COHN, M.D. AND EMANUEL FRIEDMAN, M.D.
DENVER, COLORADO

MIXED bacterial or streptococcic gangrene is a type of gangrene which is limited to the skin and subcutaneous tissues. It may be one of the most alarming and serious infections of an extremity encountered in medical practice. This condition may be considered of infrequent occurrence judging by the paucity of case reports. A survey of the literature fails to disclose any cases in which patients were treated with the sulfone derivatives or penicillin. Because of the apparent infrequency of its occurrence, it may not be recognized by one who is not thoroughly familiar with its manifestations. Due to this circumstance, coupled with the fact that so far the sulfonamides and penicillin have not been applied in combating this virulent infection, we feel justified in recording our experience with one patient treated with these drugs.

REVIEW

We are indebted to Meleney[1] for differentiating streptococcic gangrene from other types of gangrene. His observations were published in 1924. Since 1924, a total of thirty-nine authentic cases affecting the extremities has been collected from the literature. (Table 1.) This condition may occur in other regions of the body, such as the abdomen,[2,3] breast,[4] penis and scrotum,[5] vagina[6] and chest wall.[7] However, the infection, when it involves regions other than the extremities, is usually less fulminating in its course.

An analysis of the cases reported (Table 1) reveals that the disease may affect any age group. The youngest patient is eighteen months of age, the oldest sixty-one years. The male sex predominates over the female in the ratio of 5½:1. With the exception of nine cases, a focus of infection or portal of entry for the organisms was encountered in all instances, the most frequent being an abrasion, small pustule or a furuncle.

The initial finding is usually swelling, which may remain localized or may extend with alarming rapidity beyond the point of entry. An entire extremity may be involved within twenty-four hours from the onset. Pain is not marked. In gangrene due entirely or predominantly to the hemolytic streptococcus, the part involved becomes reddened. Usually on the second to the fourth days irregular patches of dusky purplish discoloration appear on this reddened surface. The reddish discoloration invariably precedes the dusky mottling and extends beyond the borders of the dusky discoloration. Vesicles and bullae may develop. The dusky areas then coalesce and frank gangrene occurs. On the eighth to the tenth day separation of the gangrenous areas takes place. Lymphadenopathy occurs rarely. Necrosis of the whole or part of the extremity may supervene. In untreated, and less frequently in treated cases, the necrosis advances and abscesses appear in distant portions of the body. The subcutaneous tissue or the lungs are the most frequent sites. Death ensued in 18 per cent of the collected cases.

The systemic reaction is usually not marked. In the collected cases (Table 1) the temperature on admission to the hospital varied from normal to 104°F. The majority of the patients had a fever ranging from 99 to 101°F. The symptoms usually associated with infection, such as malaise and prostration, are encountered. These patients do not appear as ill as one

would expect from the severity of local involvement.

A survey of the reported cases (Table 1) revealed an average white cell count of 17,000 on admission to the hospital. The count varied from 6,050 to 28,600. The polymorphonuclear percentage averaged 82, ranging from 68 to 96.

The streptococcus was found in every instance. In the majority of cases this organism was hemolytic in type. Other organisms, however, have occasionally been isolated, such as Staphylococcus albus, hemolytic and non-hemolytic staphylococcus aureus, Gram-positive diplococcus, Bacillus pyocyaneus and an unidentified Gram-positive or negative bacillus. A pure culture of hemolytic streptococcus was found in seventeen instances.

In nineteen cases blood cultures were made. No organisms were found in eleven of the cases; in the remainder hemolytic streptococci were recovered.

CASE REPORT

The patient, a white male, age eighteen and one-half months, was in good health until 7 P.M. on October 8, 1944. One week prior to this date he sustained a small sandburr wound on the thenar eminence of the right hand. This area became infected, and on October 7th the patient's aunt opened the wound with a needle. At 5 P.M. on October 8th the child was found crying outside his home. Shortly thereafter the mother noted swelling of the third and fourth fingers of the right hand. By 7 P.M. all the fingers and the entire hand were edematous. He was taken to a local medical doctor who applied splints to the forearm and wrist in the belief that the child had sustained an injury. When the child was put to bed at 9 P.M. the swelling had extended as far as the elbow. No redness or discoloration of any type was observed at this time. The child slept well throughout the night. By 10 A.M. on October 9th the entire right arm, shoulder region and right side of the chest were swollen. Patches of dusky discoloration on the dorsum of the hand and the forearm were first noted at noon on the same date.

Physcial examination at 3 P.M. on October 9th in the office revealed a well nourished child who did not appear especially ill. He was quite alert and displayed no fear or anxiety. The temperature was 99.4°F. by rectum.

On the mid region of the thenar eminence a small wound about the size of a pinhead was found. No pus could be expressed from this wound.

The entire right upper extremity was swollen at least to twice the normal size. The skin of the fingers and hand was stretched very tight. The edema extended over the right chest anteriorly and downward as far as the costal margin.

Areas of deep bluish discoloration were present over the entire right arm, shoulder region and right side of the chest. These areas of discoloration were irregular in outline and size. Some of these areas measured as much as 5 to 7.5 cm. in diameter. It should be emphasized that no erythema was noted on the involved extremity or on the chest. There was no local increase in temperature. The radial pulse was palpable. The entire affected area was exquisitely tender to touch and the patient resented most emphatically any attempt at movement of the right arm. Crepitation of tissue was not detectable.

A general examination failed to reveal any noteworthy findings. The white count showed 10,800 cells with 54 per cent polymorphonuclear leukocytes and 44 per cent lymphocytes. A roentgenogram of the right arm did not evince the presence of gas in the soft tissues.

The patient was admitted to Mercy Hospital at 5:30 P.M. on October 9th. Ten thousand units of penicillin were administered intramuscularly immediately upon admission. At 7 P.M. 15 gr. of sodium sulfadiazine were given subcutaneously. The penicillin was repeated at 8:45 P.M.

At 9:15 P.M. the purplish discoloration of the arm had increased in intensity and extent. The swelling of the right side of the chest wall had progressed as far as the midline and the purplish areas had increased in size. No blebs, bullae, erythema or crepitation of tissue were noted. When not disturbed, the patient displayed no evidence of pain or even discomfort. His temperature had not exceeded the admission level of 99.4°F. by rectum. The pulse was of good quality and not unduly accelerated. He took liquids readily.

Author	Age	Sex	Portal of Entry	Duration of Illness before Hospitalization	Admission Temperature	Admission White Count	Per Cent Polymorphonuclear Cells	Part Involved	Organism from Wound	Blood Culture	Treatment	Result on Discharge
Meleney, F. L.[1] (1924)	30	M	Boil	4 days	100.7	6,400	..	Foot	Hem. strep. Staph. aur. Gram + B.	Pos. hem. strep. 8th day	Incisions Hot soaks	Amputation advised. Refused. Went home against advice.
	61	M	Injury	2 days	97.9	14,400	82	Hand	Hem. strep.	Neg.	Hot water soaks Dakinization Reverdin graft	Well
	40	M	Hypo. inj.	6 days	99.7	18,300	72	Forearm	Hem. strep.	.....	Incision Dakinization Reverdin graft	Well
	30	M	Boil	Approx. 14 days	100.4	16,000	..	Leg	Hem. strep.	.....	Incisions Hot water soaks Dakinization Reverdin graft	Almost well
	32	M	Ulcer	14 days	100.7	10,500	..	Foot	Hem. strep.	Hem. strep.	Incisions Hot soaks Dakinization	Amputation of lower third of thigh. Well.
	32	F	None	7 days	103.3	14,800	69	Arm	Hem. strep.	Neg.	Incisions Dakinization Reverdin graft	Well
	80	M	Boil	14 days	99.3	8,500	80	Forearm	Hem. strep.	Neg.	Dakinization Reverdin graft	Well
	44	M	None	15 days	100.4	19,850	89	Thigh	Hem. strep.	Neg.	Incisions Dakinization Reverdin graft	Well
	35	M	Boil	23 days	98.6	12,000	67	Arm	Hem. strep. Gram + B. (unidentified)	.....	Incisions Dakinization Reverdin graft	Well
	54	M	Comp. fract.	3 days	95	14,200	91	Wrist	Hem. strep. Staph. aur. Gram + B. (unidentified)	Hem. strep.	Dakinization	Amputation of arm. Died (17th day)
	17	F	Frostbite	15 days	99	16,700	80	Foot	Hem. strep. Nonehm. staph. aur. Gram + fusiform B.	Pos. 9th day	Incisions Hot saline soaks Reverdin graft	Well
	14	M	"Sprained" ankle	14 days	102.5	10,400	77	Foot	Hem. strep. Nonhem. staph. aur. Hem. staph. aur. B. Welchii	Hem. strep.	Foot disarticulated at ankle	Amputation lower third of tnigh. Died (5th day)
	25	M	Corn	4 days	103	21,000	83	Foot	Hem. strep.	Pos. 2nd day	Incisions Hot water soaks Dakinization Reverdin grafts	Well
	33	M	Abrasion	16 days	101	20,000	83	Leg	Hem. strep.	Neg.	Incisions Hot water soaks Dakinization Reverdin and Thiersch grafts	Wounds not healed.
	37	M	Hypo. inj.	17 days	100.6	28,000	96	Arm	Hem. strep. Staph. aur. B. pyocyan.	Hem. strep.	Incisions Hot soaks	Died (27th day)
	23	M	Scratch	7 days	100.2	76,000	90	Forearm	Hem. strep.	Neg.	Incisions Hot soaks Dakinization Reverdin graft	Well
	23	M	None	10 days	100.4	19,200	82	Leg	Hem. strep. G.+ and G.− B.	Neg.	Incisions Hot water soaks Reverdin graft	Well

Meleney, F. L.[1] (1924)	17	M	Injury	4 days	99.3	18,000	87	Foot	Hem. strep.	.....	Incisions Hot water soaks Dakin sol. soaks	Well
Lyle, H. H. M.[8] (1925)	..	M	.....	.....	.....	.....	..	Arm	.....	.....	Debridement Dakinization Thiersch grafts	Not given
Jen, T. K.[5] (1929)	49	M	Infected scabies	Uncertain	97.2	10,200	83	Right leg	Hem. strep.	.....	Debridement Lysol (1: 300) soaks Dakinization	Improved
	54	M	Abrasion	18 days	97.2	7,500	82	Foot and leg	Strep.	.....	Debridement Lysol (1: 300) soaks	Improved
	55	M	Small pustule	24 days	97	17,700	78	Hand and forearm	Strep. Diplo.	.....	Incisions Debridement Dakinization	Well
	55	M	Skin disease	13 days	98.3	28,600	77	Leg	Staph. Strep.	.....	Incisions Debridement Reverdin grafts	Well
	31	M	None	14 days	101	13,000	72	Thigh	Hem. strep.	.....	Lysol (1: 400) soaks Dakinization Reverdin grafts	Almost well
	46	M	None	5 days	101.4	23,400	83	Leg	Hem. strep. Staph. alb.	.....	Incisions Debridement Dakinization	Well
	26	M	Abrasion Contusion	13 days	102	14,000	89	Leg	Hem. strep.	.....	Incisions Hot water soaks Dakinization	Improving
Bate, J. T.[6] (1929)	55	M	.....	.....	.....	.....	..	Foot	Hem. strep.	Neg.	Incisions Dakinization	Amputation lower third of thigh. Recovery.
	40	M	.....	.....	.....	.....	..	Arm	Hem. strep.	.....	Incisions Dakinization	Well
Meleney, F. L.[9] (1929)	.....	M	.....	24 hours	103	22,000	86	Foot	Hem. strep.	Neg.	Incisions Dakinization	Well
		F	.....	4 days	103	24,000	88	Leg	Not stated	Neg.	Incisions Dakinization Thiersch graft	Not stated
Gage, A.[10] (1929)	Adult	M	Laceration	3 days	Septic	.....	..	Foot	Hem. strep.	.....	Mult. incisions	Died
	Adult	M	Laceration	3 days	Sl. elev.	.....	..	Foot	Hem. strep.	.....	Incisions 2% mercurochrome packs	Cured
	Adult	M	Laceration	4 days	102	.....	..	Leg	Hem. strep.	.....	Incisions 2% mercurochrome packs. Daily $KMnO_4$ soaks.	Satisfactory
Bettman, A. G.[11] (1931)	46	F	Inf. insect bite	1 day	104	12,500	87	Arm	Strep.	Hem. strep. (6th day)	Strep. erysipelas antitoxin. $KMnO_4$ dressings. Incision Dakinization	Died (17th day)
	43	M	Scratch	3 days	104	.....	..	Arm	.....	.....	Boric acid packs S.T.37 packs	Recovery very slow
Mainzer, F. S.[12] (1931)	48	M	Contusion	3 days	102.2	6,050	68	Leg	Strep.	Neg.	Incisions	Died following operation.
Lautré, M. A.[13] (1933)	32	F	Bamboo splinter	2 days	99	.....	..	Foot	Strep.	.....	Incisions	Died (6th day)
Simpson, B. S.[14] (1936)	24	M	Probable abrasions or scratches	1 day	103.6	.....	..	Hand Arm	Hem. strep.	.....	Incisions Antistrep. (polyvalent) serum. Antiseptic baths	Recovery
Probstein, J. G. and Heifetz, C. J.[15] (1938)	18 mo.	F	Scratch	10 days	100.4	20,500	..	Leg	Short chain strep. G.+ diplo.	Neg. (22nd day)	Hot boric packs Repeated blood transfusions	Wounds healed
Author's case	18½ mo.	M	Wound thenar eminence	24 hours	99.4 (R)	10,800	54	Right upper extremity, chest, neck, left shoulder, back	Nonhem. strep. Staph. alb. Gram—rod	.....	Incisions of arm Penicillin and sulfadiazine	Complete recovery without sloughing of tissue.

Multiple incisions were made upon the right upper extremity at 11 P.M. under ether anesthesia. No tourniquet was used. An incision approximately five inches in length was made over the radial aspect of the forearm. The incision extended down to the muscle. No escape of gas was noted. A moderate amount of serum exuded from the wound. A smear and culture were made. There was no bleeding whatsoever. The subcutaneous tissue was deep purple in color. The fascia overlying the muscle was split and revealed normal appearing muscle tissue. A second incision of about the same length was made over the ulnar aspect of the forearm. Because of marked edema retraction of the wound margins took place. Two similar incisions were made on the arm over the anterior and posterior aspects; exactly the same appearance of the tissues was noted. Only one bleeding vessel was encountered in making these four incisions. The chest wall was not incised. Eighty thousand units of penicillin were injected directly into the tissues of the arm, forearm and chest. Dry dressings were applied.

Following surgery, the patient continued to receive 10,000 units of penicillin every three hours until October 16th, making a total dosage of 5,200,000 units. He was also given 7.7 gr. of sulfadiazine every four hours during the day for the same length of time.

The maximum temperature was 101°F. by rectum on the first postoperative day, following which it receded slowly until the eighth postoperative day, when it was normal and did not rise again above this level. Daily blood studies were made. The highest white cell count was 23,700 with 77 per cent polymorphonuclear leukocytes and 23 per cent lymphocytes on the second postoperative day. The total count gradually decreased and on October 18th the count was 9,800 with 24 per cent polymorphonuclear leukocytes and 76 per cent lymphocytes. The urinalyses were negative throughout the period of hospitalization.

Fig. 1. Photograph taken on the third day of illness (second postoperative day). Note the marked edema of right arm, chest wall and neck. The dusky discoloration of these areas is evident.

Bacteriological studies consisted of anaerobic and aerobic cultures. Short chain, Gram-positive, non-hemolytic streptococci, Staphylococcus albus and an occasional Gram-negative long, thin rod, some of which appeared to be spore-bearing, were recovered from the anaerobic culture. The original aerobic culture did not show any growth. The non-hemolytic streptococcus appeared to be the predominant organism.

The wounds were dressed on the second postoperative day. A thin, serous drainage saturated the dressings. The subcutaneous tissue at this time presented a healthy, normal appearance and bled freely. The edema of the entire arm was slightly less pronounced. The discoloration was considerably less striking

than prior to operation. Sulfathiazole powder topically and dry dressings were used exclusively throughout the course of the illness.

FIG. 2. Photograph of back taken on the same day. Dusky discoloration of the upper portion of the back and left shoulder is present.

On October 10th it was noted that swelling and discoloration of the chest wall had progressed. Swelling and purplish mottling of the neck were observed for the first time on the morning of this date. (Fig. 1.) At this time considerable edema and discoloration of the entire left shoulder region and the posterior chest wall as far as the costal margin were noted. (Fig. 2.) The intensity of the discoloration of these latter areas was more pronounced than that observed on the right arm at any time. The discoloration reached its maximum intensity on October 15th, following which it began to fade gradually in all areas. On October 11th the edema of the anterior chest wall and neck was more marked. Recession of the edema did not begin until October 12th.

At the time of the patient's discharge from the hospital on October 23rd, the edema and discoloration of all the involved regions had disappeared entirely. Very little drainage of the wounds was evident. The drainage ceased entirely on November 21st. There was no disability of the right upper extremity.

COMMENT

The case presented differs from all the cases of mixed bacterial or streptococcic gangrene recorded in the literature by one outstanding feature, namely, the absence of erythema. A zone of erythema which appears before the onset of the gangrene and extends beyond the area of dusky discoloration has been emphasized as a predominant finding in all the reports. We believe, however, that there can be no doubt that our case is one of mixed streptococcic and staphylococcic gangrene. It is possible that the absence of the hemolytic streptococcus accounts for the absence of the erythematous stage of the disease.

The therapeutic regimen recommended in the literature consists of multiple incisions of all discolored areas, followed by Dakinization or various types of wet dressings. The sloughs should be removed and the denuded areas grafted with skin. It should be emphasized that in our case no sloughs occurred. In view of the locally destructive changes and the mortality rate of 18 per cent of the cases hitherto reported, it is believed that the excellent result obtained in our case was due to the very early and thorough treatment with penicillin and sulfadiazine.

It is interesting to speculate what might have been the outcome in our case if surgery had been omitted and sole reliance placed on penicillin and sulfadiazine. It was pointed out that the chest, neck, left

shoulder and back, which were not treated surgically, responded favorably to sulfadiazine and penicillin. These areas were eventually more edematous and discolored than the right arm which was incised. Meleney[1,9,16] insists that all the discolored areas be incised up to but not through the zone of erythema. It is possible that the armamentarium of penicillin and sulfadiazine alone may suffice for the control of early infection, thus making mutilating incisions unnecessary.

Cases of mixed bacterial or hemolytic streptococcic gangrene are rare. Nevertheless this disease must be considered in the differential diagnosis of acute gangrene of an extremity. Where crepitation of the tissues is not elicited, appropriate treatment should not await the outcome of bacteriological studies which may require several days. The diagnosis must be made upon a clinical basis and treatment instituted as soon as possible.

SUMMARY

1. A discussion of mixed bacterial acute gangrene of an extremity is presented.

2. A review of recorded cases is prepared in tabulated form.

3. A case of mixed bacterial acute gangrene of an extremity treated by multiple incisions, penicillin and sulfadiazine is reported in detail.

4. No sloughing of the tissues occurred with this regimen, in contrast to the disfigurement which resulted in all cases treated by the previous methods.

REFERENCES

1. Meleney, F. L. Hemolytic streptococcus gangrene. *Arch. Surg.*, 9: 317, 1924.
2. Meleney, F. L. Haemolytic streptococcus gangrene following the administration of scarlet fever antitoxin. *Ann. Surg.*, 91: 287, 1930.
3. Meleney, F. L. Bacterial synergism in disease processes with a confirmation of the synergistic bacterial etiology of a certain type of progressive gangrene of the abdominal wall. *Ann. Surg.*, 94: 961, 1931.
4. Fallon, J. Hemolytic streptococcal subcutaneous gangrene. *Arch. Surg.*, 18: 1817, 1929.
5. Jen, T. K. Haemolytic streptococcus gangrene. *China M. J.*, 43: 889, 1929.
6. Bate, J. T. Subcutaneous streptococcus gangrene. *Ann. Surg.*, 90: 1079, 1929.
7. Poate, H. R. G. Spreading gangrenous inflammation. *M. J. Australia*, 2: 398, 1930.
8. Lyle, H. H. M. Haemolytic streptococcus gangrene of arm and forearm. *Ann. Surg.*, 82: 813, 1925.
9. Meleney, F. L. Hemolytic streptococcus gangrene. Importance of early diagnosis and early operation. *J. A. M. A.*, 92: 2009, 1929.
10. Gage, A. Strepticoccal subcutaneous necrosis with gangrene of the skin. *Medical Progress*, 45: 30, 1929.
11. Bettman, A. G. Hemolytic streptococcal gangrene. *Northwest. Med.*, 30: 28, 1931.
12. Mainzer, F. S. Acute streptococcic hemolytic gangrene. *Pennsylvania M. J.*, 39: 711, 1931.
13. Lautré, M. A. A case of acute haemolytic streptococcal gangrene of the skin. *South African M. J.*, 7: 692, 1933.
14. Simpson, B. S. Haemolytic streptococcus gangrene. *Brit. M. J.*, 1: 261, 1936.
15. Probstein, J. G. and Heifetz, C. J. Acute hemolytic streptococcic gangrene of skin and subcutaneous tissue. *J. Missouri M. A.*, 35: 115, 1938.
16. Meleney, F. L. The importance of early diagnosis and early operation in hemolytic streptococcus gangrene. *Bull. N. Y. Acad. Med.*, 5: 552, 1929.
17. Meleney, F. L. A differential diagnosis between certain types of infectious gangrene of the skin with particular reference to haemolytic streptococcus gangrene and bacterial synergistic gangrene. *Surg., Gynec. & Obst.*, 56: 847, 1933.

SURGICAL ASPECTS OF CERTAIN BLOOD DYSCRASIAS

DAMON B. PFEIFFER, M.D. AND F. M. SIMMONS PATTERSON, M.D.

Chief of Pfeiffer Surgical Clinic, Abington Memorial Hospital

Member of Pfeiffer Surgical Clinic, Abington Memorial Hospital

ABINGTON, PENNSYLVANIA

THERE are certain blood dyscrasias that respond miraculously to surgery. There are others for which surgery gives palliative relief, and there are still others for which surgery offers nothing. Surgery in these blood dyscrasias is limited mainly to splenectomy. The spleen has been called an organ of mystery, but it is not essential to life, because following its surgical removal its function is adequately taken over and compensated for by other tissues of the body. A splenectomy should never be done in the treatment of blood dyscrasias unless the surgeon has a thorough knowledge of these diseases and has adequately studied the case in question.

The spleen is a complex organ, and its functions are many. Its physiology is very complex. Suffice it to say that of its many and varied duties the following are of importance in its relation to blood dyscrasias: (1) In fetal life the spleen is one of the sources of formation of practically all of the blood elements. (2) It plays a very important part in blood destruction, since the spleen contains large numbers of reticulo-endothelial cells. (3) It has some regulatory action on the fragility of the blood, probably through the secretion of a hormone that in some way, generally or locally, may affect hematopoiesis. (4) In some unknown fashion it is concerned with the formation or destruction of platelets. (5) Being a part of the reticulo-endothelial system it is concerned with disturbances of lipoid metabolism.

There are much experimental data to substantiate these assumptions. In all of the blood dyscrasias a perversion of the reticulo-endothelial system is present to some extent. The thought has recently arisen that this perversion may have as a part basis nutritional faults such as vitamin B and C deficiencies.

Familial Hemolytic Anemia. This is the first blood dyscrasia that we wish to mention that responds nobly to splenectomy. This condition is a chronic familial and congenital anemia characterized by jaundice, splenomegaly, increased fragility of the erythrocytes, spherocytosis of the red cells, and the occurrence of "crises." These crises are characterized by attacks of nausea and vomiting accompanied by pain over the spleen, deepening of the jaundice, chills and fever. The splenic enlargement, the characteristic microscopic picture of red blood cell engorgement in the spleen, with large amounts of hemosiderin, and the marked improvement following splenectomy in typical cases all indicate that hyperfunction of the spleen plays a prominent part in the excessive blood destruction in this disease. As a rule, splenectomy is followed by the disappearance of all symptoms, but usually the increased fragility and spherocytosis of the red cells persists. In many cases gallstones are present in the gallbladder, and cholecystectomy is here indicated. During the past year the junior author reported three cases in one family on which splenectomies were performed with excellent results.

Idiopathic or Primary Thrombocytopenic Purpura. This is the second blood dyscrasia for which splenectomy offers excellent results. Clinically this is a disease of early life, and it is often familial in nature. Its outstanding characteristics are a tendency to bleed easily and excessively into the skin and from the mucous membranes, splenomegaly in a large percentage

of the cases, and a marked diminution in blood platelets. Examination of the blood reveals in addition to a low platelet count a prolonged bleeding time, a normal coagulation time, and absence of clot retraction. The disease may be acute or chronic in nature, the latter being characterized by remissions. A widely accepted theory as to the etiology of this disease is that excessive thrombocytolytic activity of the spleen causes an increase in platelet destruction.

Splenectomy in this disease, first advocated by Kaznelson in 1916, offers brilliant results. Temporary improvement may be noted following medical treatment, but relapses always occur. The optimum time for operation is during the quiescent period, and the best results are obtained when splenectomy is performed following the first bleeding episode. Whether or not to operate in the acute form of purpura is a controversial point, but sometimes it is a necessity. If operation is performed in the acute phase, it should be done before the patient has bled to the point that he is a poor operative risk.

On the other hand, splenectomy is not indicated but is rather contraindicated in secondary thrombocytopenic purpura due to severe infections or intoxications. The treatment here lies in satisfactorily attempting to control the disease or factor which is causing the platelet destruction.

Splenic Anemia. This third disorder also responds brilliantly to splenectomy if the latter is done early in the disease. Many cases are thus permanently cured, and many more lead useful lives for long periods of time. As Osler stated, "splenic anemia is an intoxication of unknown nature characterized by great chronicity, progressive enlargement of the spleen which cannot be correlated with any known cause, anemia of the secondary type with leukopenia, a marked tendency to hemorrhage, particularly from the stomach and esophagus, and in many cases a terminal state with cirrhosis of the liver and jaundice." This entire symptom complex is known as Banti's disease, whereas the diagnosis "splenic anemia" is justified when the early phenomena of splenomegaly and secondary anemia exist. Many authorities believe that in this disease the spleen exerts in some way a depressing effect on bone marrow activity. That the spleen plays a great rôle in this disease process is shown by the cures resulting from splenectomy in early cases.

At any time in the course of the disease splenectomy is imperative. The earlier the operation, the greater the chance for cure. Operation even after cirrhosis of the liver has appeared offers many excellent results. When splenectomy is performed ligation of the coronary vein is worthy of a trial. Even if operation is performed in early cases, gastrointestinal hemorrhage is a frequent postoperative occurrence.

Gaucher's disease, although primarily a disease of lipoid metabolism, should be considered under the blood dyscrasias because of the changes present in the peripheral blood and changes in the reticulo-endothelial system of which the spleen is the largest reservoir. This disease is characterized by marked splenomegaly without ascites, moderate hepatic enlargement, lymphadenopathy, bronzed pigmentation of the exposed skin and a familial tendency. Blood examination reveals a hypochromic anemia and leukopenia. This is a disease of early life and runs a slowly progressive course, but may terminate quickly due to some intercurrent disease. Diagnosis may be established by splenic or bone marrow puncture for large vacuolated cells known as Gaucher's cells, by lymph gland biopsy or *x*-ray examination of the bones. A disturbance in lipoid metabolism is only one phase of this disease, but the exact nature of this disturbance is unknown. In this disease the destructive action of the reticulo-endothelial system is exaggerated. Splenectomy offers no hope of cure, but it is a good palliative measure when there exists a

large burdensome spleen with thrombocytopenia and a hemorrhagic diathesis.

The second blood dyscrasia for which splenectomy is an excellent palliative measure, but not a cure, is VonJaksch's anemia. Clinically this condition is usually congenital and common to children of the Mediterranean races. It is characterized by marked splenomegaly, some hepatic enlargement, pallor or jaundice of the skin, enlargement of the peripheral lymph nodes, and enlargement of the facial bones giving the child a Mongolian appearance. Blood examination reveals a marked increase in young nucleated red cells with a marked change in their shape and size, a moderate anemia, and a leucocytosis with a relative lymphocytosis. This dyscrasia is a disease of abnormal hematopoiesis and runs a chronic, progressive, fatal course. Splenectomy simply relieves the child of the annoyance of a progressive splenomegaly.

There are other blood dyscrasias for which splenectomy has been performed such as pernicious anemia and polycythemia vera. The miraculous results obtained in pernicious anemia by the use of liver have pushed splenectomy into the background. Phenylhydrazine and irradiation offer the greatest possibility of cure to the polycythemia patient, and splenectomy has not given the results here to make it a standard method of treatment.

Recently on the surgical service of the senior author at the Abington Memorial Hospital there have been two patients with thrombocytopenia. These cases are briefly reviewed because they teach a definite lesson to the surgeon.

CASE REPORTS

Case I. This patient was a fifteen year old white male who was admitted to the hospital because of repeated attacks of epistaxis. On admission he was bleeding from the nose and gums. The Rumpel-Leed's tourniquet test was positive, and the spleen was not palpable. Blood studies were typical of thrombocytopenic purpura, no platelets being demonstrable. No intoxication or infection which might explain the platelet absence was demonstable. The patient's condition became very precarious, the bleeding became more free and generalized. A splenectomy was performed although the patient was nearly moribund. The spleen was enlarged to twice the normal size. Following operation the platelet count rose to 50,000 on the sixth postoperative day, the bleeding time decreased, and the hemorrhagic diathesis stopped. An interesting feature of this case was that a preoperative bone marrow biopsy showed a reduction of megakaryocytes, and that the megakaryocytes present were abnormal. This pointed to the fact that the etiology of the thrombocytopenia was an impaired formation of the megakaryocytes which are the precursors of platelets. Splenectomy, theoretically would be to no avail here. However, it was done as a life-saving procedure, and the result was just that.

Case II. The second patient was a sixty-three year old white male admitted to the hospital because of hemoptysis, a generalized rash and abdominal pain. It was found that he had long suffered from sinus trouble, and in the distant past had received anti-luetic therapy. Examination revealed: (1) a rash on all extremities; (2) a maxillary sinusitis; (3) splenomegaly; (4) moderate hepatomegaly. Blood studies revealed: (1) a leucocytosis of 19,500; (2) a platelet count of 57,000; (3) normal bleeding and coagulation times. Following admission he bled freely from his right ear. This man was suffering from a secondary thrombocytopenic purpura secondary to a maxillary sinusitis. He responded well to drainage of the sinuses, blood transfusions, high caloric, high vitamin diet, and other appropriate medical therapy.

These two cases are excellent examples of the two types of thrombocytopenic purpura. In the first case splenectomy was indicated and was done. A remarkable recovery followed. Splenectomy was not indicated, but rather contraindicated, in the second case. Operation might have caused a fatality. Therefore, it is essential to study the blood dyscrasia in question thoroughly, and be sure that operation is indicated before any such procedure is undertaken.

SUMMARY AND CONCLUSIONS

1. The important functions of the spleen in relation to blood dyscrasias are mentioned.

2. Splenectomy offers excellent results in familial hemolytic anemia, primary thrombocytopenic purpura and Banti's disease.

3. Splenectomy offers palliative relief in Gaucher's disease and VonJaksch's anemia.

4. Two cases of thrombocytopenic purpura are reviewed.

REFERENCES

1. Hanrahan, E. W., Jr. and Vincent, Beth. Surgery of the Spleen-Lewis Practice of Surgery. Vol. 6, chap. 15.
2. Pfeiffer, D. B. Diseases of the Spleen. Christopher's Textbook of Surgery. Pp. 1354–1366, 1937.
3. Yater. Fundamentals of Internal Medicine. Pp. 177–518, 1938.
4. Hudock, E. B. and Patterson, F. M. S. Congenital hemolytic anemia. *Clinics*, 1: 1021–1033, 1942.
5. Kaznelson, P. Splenogene Thrombolytische Purpura. *Wien. klin. Wchnschr.*, 29: 1451, 1916.
6. Elliot, R. H. E. Diagnostic and therapeutic consideration in the management of idiopathic thrombocytopenic purpura. *Bull. New York Acad. Med.*, 15: 197–210, 1939.

Whatever may be the cause of shock, it must be insisted upon that the condition is a *failure of the circulation*. Clinically this is shown by a fall of blood pressure. The fall in blood pressure follows, rather than initiates, the onset of shock. It will occur only when the compensatory mechanism of the body which maintains the circulation commences to break down.

From "Surgery of Modern Warfare" edited by Hamilton Bailey (The Williams and Wilkins Company).

PRIMARY REPAIR OF THE PAROTID DUCT*

F. T. WALLACE, M.D.
Teaching Fellow in Surgery, Medical College of the State of South Carolina
CHARLESTON, SOUTH CAROLINA

DIVISION of the parotid duct frequently results in a distressing salivary fistula. The saliva from the corresponding parotid gland drains through the scar onto the cheek. This can be prevented by a primary repair of the parotid duct.

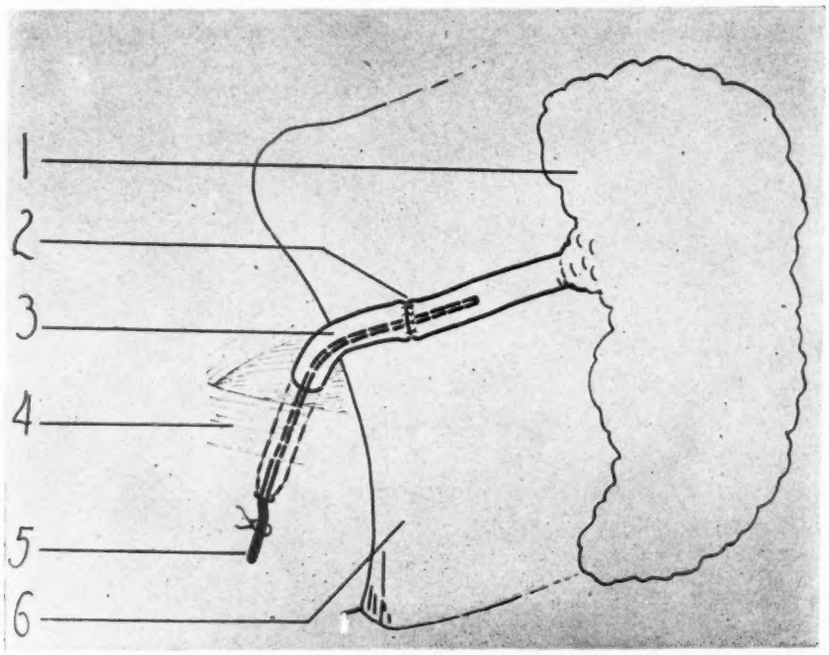


FIG. 1. Diagram of parotid duct repair: 1, parotid gland; 2, line of division; 3, parotid duct; 4, buccinator muscle; 5, silkworm gut dowel sutured to buccal mucosa; 6, masseter muscle.

The important points in the successful repair of the duct are early repair, the use of an inlying dowel, and the fixation of this dowel until healing of the duct occurs. The ends of the severed duct are identified. A strand of silkworm gut is passed into the proximal end to the most medial portion of the parotid gland. The remainder of the strand is passed into the distal severed end, through the distal portion of the duct and into the mouth through the oral orifice of the duct opposite the upper second molar tooth. (Fig. 1.) The strand is anchored to the buccal mucosa from within the mouth with a single suture. The silkworm gut dowel acts as an internal splint and facilitates accurate approximation. A similar technic has been used for the repair of a parotid duct fistula.[3] In that case the dowel was anchored to the second molar tooth.

The following dowels have been used: a strand of catgut,[6] a strand of silkworm gut,[5] a ureteral catheter,[1] a filiform ureteral bougie,[2] and a strand of horsehair.[4] The method of fixation of the dowel to the buccal mucosa presented in this case is simple and satisfactory. Brohm and Bird[2] fixed the dowel by passing it back out

* From the Department of Surgery, Medical College of the State of South Carolina, and Roper Hospital, Charleston, South Carolina.

through the cheek and suturing it to the skin.

CASE REPORT

Hospital No. 32658. A thirty year old colored male entered Roper Hospital September 23, 1944, soon after sustaining a laceration of the face from 3 cm. anterior to the ear on the zygoma to the chin. After thorough preparation and under local anesthesia, the ends of the parotid duct were identified. The division was in the middle, or masseteric, portion. A laceration in the masseter muscle underneath the parotid duct was repaired after sulfathiazole crystals were instilled.

A strand of silkworm gut was passed for 1 cm. into the proximal severed end of the parotid duct. The remainder of the strand was passed into the distal severed end into the oral cavity. The silkworm gut was sutured to the buccal mucous membrane near the oral orifice of the parotid duct with a single suture. (Fig. 1.)

The ends of the duct were approximated by uniting the fascial sheath with a single layer of interrupted cotton sutures. The laceration was closed without drainage with interrupted cotton sutures. Per primam healing occurred. The silkworm gut was removed on the seventh day. At a follow-up visit two weeks later in the out-patient department, no external or internal fistula was present. There was no pain or swelling of the parotid gland after meals. The result appeared to be entirely satisfactory.

SUMMARY

Primary repair of the parotid duct is discussed, and a case presented.

REFERENCES

1. Black, H. S. and Flagge, P. W. Successful anastomosis of Stenson's duct. *South. M. & Surg.*, 90: 755, 1928.
2. Brohm, C. G. and Bird, C. E. Primary repair of severed parotid duct. *J. A. M. A.*, 104: 733, 1935.
3. Butler, E. and Guinan, E. R. Successful repair of Stenson's duct. *Surg. Clin. North America*, 13: 1291, 1933.
4. Christafferson, E. A., Ajalat, M. P. and Gradman, R. Successful primary repair of lacerated parotid duct. *Am. J. Surg.*, 59: 592, 1943.
5. Dickinson, A. M., Injuries to Stenson's duct. *New York State J. Med.*, 27: 548, 1927.
6. Tees, F. J. Primary repair of injuries to the parotid duct. *Canad. M. A. J.*, 16: 145, 1926.

Selected Book Reviews

As a rule a good and needed work goes through a process of editorial and publishing evolution; the mistakes and ommissions in the original published text are corrected and balanced in subsequent editions. This is not especially true of Titus's work.[1] He did an adequate and thorough job in the first edition (1937); and although he has brought the work up to date in the second edition and made changes and additions (science never stands still, not even obstetrics . . . as old as man), in either edition the book is outstanding in its field.

Many physicians just "have" to do midwifery. If everything is normal, and the labor is normal with a mother and baby normal, and a fairly normal birth is the outcome, the physician gives a sigh of relief and emerges from a panic of apprehension. But all births are not normal. The pathway of labor is one of many cul-de-sacs and pitfalls. It is well for the physician to know when he is in trouble, when to call for expert aid, or, better still, know how to meet and solve the difficulty.

Therefore, to all who are obstetricians or "do obstetrics" we urge they own this work, which is a successful effort to develop a practical aid for those who are meeting and contending with obstetrical difficulties. It is not a conventional textbook, but to advanced students, residents and young practitioners (in fact, to all but the expert) it will prove an invaluable help.

There is no need to review the scope of the contents. Suffice that it covers the subject, that it has been written by a recognized authority, and in every way should be labelled "standard and outstanding."

Although the medical journals of the country have given the subject of pain in childbirth frequent and wide space, we, nevertheless, are of the opinion that every physician who "does obstetrics" (with a few reservations) would do well to read, reread and

[1] The Management of Obstetric Difficulties. By Paul Titus. 2nd ed. St. Louis, 1945. C. V. Mosby Company. Price $8.50.

study parts of Lull's book.[2] It covers thoroughly the subject of the control of pain in childbirth.

As is well known, there are many methods or ways to lessen or abolish pain in childbirth. Because the lay public demands the control of this pain, many physicians resort to one or more measures in order to be labelled modern and to curry favor with "women who bear children." Some methods are comparatively safe, both to mother and baby; others are all right if they work and nothing untoward ensues; some methods call for experience and great technical skill; in others a skilled anesthetist must be called. In order to evaluate these many methods, know the history and growth of man's attempt to control the pain of bearing offspring in the human, become familiar with the various methods and technics of administering various drugs, and being made aware of the end-results, we urge that this book be studied. It covers all forms of anesthesia, analgesia and amnesia, and has a complete set of charts that show the effects of the various drugs on both the maternal and fetal organs.

The book is wholeheartedly recommended. It is profusely illustrated, and the publishers have done well to offer it at a comparatively low price, when today one considers the costs of illustrations in color, with which this book abounds.

We are told that thirty-six of the thirty-seven collaborators in Principles and Practice of Surgery[3] work together in the hospital and medical school of Temple University. It is a truism that the work mirrors the latest surgical advances and offers the reader a concise text despite the large amount of material on the nature, diagnosis and modern treatment of all surgical conditions. Wounds acquired in war and in civil life and the injuries and infections sustained from animal and vegetable parasites and viruses are given adequate space. Treatment is given in great detail. But we have not the space to tell of the many surgical fields and byways covered. The subject is covered and in detail, as noted by the scope of its Four Parts: General Surgery, Surgical Technique, The Surgery of Systems and Regional Surgery.

This book is unique in that it is so uniform in its smoothness and

[2] Control of Pain in Childbirth. By Clifford B. Lull and Robert A. Hingson. Philadelphia, 1944. J. B. Lippincott Company. Price $7.50.

[3] Principles and Practice of Surgery. By W. Wayne Babcock. Philadelphia, 1944. Lea & Febiger. Price $12.00.

dovetailing, especially when one considers its many co-authors. Doctor Babcock has done an excellent bit of both writing and editing, and the text should find space on your bookshelf.

Those interested in clinical roentgenology of the digestive tract will welcome a second edition of Feldman's book[4] because the first edition was well received and was found sound and worth while.

This new edition, thoroughly revised and completely reset is (we read and agree) "essential for the roentgenologist and gastroenterologist, as well as the internist (and we add, the surgeon) who not satisfied merely to accept the reports of others, wishes to satisfy himself about the interpretation of gastrointestinal films." With this we agree only with reservations. We believe a well trained and experienced roentgenologist, in the last analysis, is the man to lean on. His diagnosis and advise should be accepted. It is common practice in many hospitals (especially those with a well equipped *x*-ray department, usually in the larger hospitals) for the internist and surgeon to stand by while the roentgenologist describes what he sees and builds up to the "why" of his diagnosis. Some internists and surgeons become quite expert in this work, and now and then venture to air their own opinions and deductions. This work will prove of great value to this class of practitioner. Also, it will be found a gold mine to the student, the junior physician learning the art of reading films, and anyone else interested in knowing how to make a diagnosis, or associate the clinical findings of trouble in the digestive tract with what is revealed in a roentgenological film.

This is a large book, 769 pages; there are 551 figures; throughout the text References are given; and there is an ample Index.

Naturally Golden's[5] work will be of interest to radiologists, but the surgeon and internist who knows how to read films will find it time well spent in going through its pages. The author does not attempt to be all inclusive in his discussion from the standpoint of the pathologist, anatomist and physiologist; neither does he discuss the treatment of disease of the small intestine.

The material has been assembled over a period of years. Many instructive cases have been sent the author by colleagues from all

[4] Clinical Roentgenology of the Digestive Tract. By Maurice Feldman. 2nd ed. Baltimore, 1945. The Williams & Wilkins Company. Price $7.00.

[5] Radiologic Examination of the Small Intestine. By Ross Golden. Philadelphia, 1945. J. B. Lippincott. Price $6.00.

parts of the country. In fact, much of the material comprising the text has been presented at instructional courses at meetings of the American Roentgen Ray Society and the Radiological Society of North America.

The book covers such subjects as The Normal Small Intestine Roentgen Examination. The Small Intestine of the Infant, Peritoneal Adhesions and Ileus, The Miller-Abbott Tube in the Diagnosis and Treatment of Ileus, Disorders of Nutrition, Diseases of the Mesentery, Allergy, Inflammations, Neoplasms, Certain Conditions of Developmental Origin, Some Effects of Food on the Small Intestine, Effects of Certain Drugs, and Miscellaneous Conditions, such as External Hernia, Excessive Food in the Jejunum, Emotion, Acquired Diverticula, Simple Ulcer, and so forth.

There are 183 subjects and seventy-five figures, as well as an ample Bibliography and Index.

Caldwell's manual[6] containing 303 pages and ninety-two illustrations, is a worth while book on the treatment of fractures, especially at this time when so many war casualties are being handled.

The author tells us that so much has been written and so many mechanical gadgets and splints have been described that the average practitioner finds it difficult to evaluate them. Therefore, he has aimed, and successfully, to suggest or describe one or two procedures for each of the common types of fracture which have given satisfactory results in his experience. Special stress has been given to compound fractures and the use of the sulfonamides in the prevention and treatment of infections. For the sake of simplicity and clarity in illustration, line drawings have been used throughout; some have been redrawn from current textbooks.

Every young physician in the armed forces and every practitioner, who is called upon as the first person to diagnose and treat fractures, would do well to read and read carefully this well written and concise work.

First of all congratulations to the Publisher who has provided a good looking book[7]—good paper, well printed, and the illustrations (234) exceptionally well done.

[6] Treatment of Fractures. By Guy A. Caldwell. New York, 1943. Paul B. Hoeber, Inc. Price $5.00.

[7] Neuro-Ophthalmology. By Donald J. Lyle. Springfield, Ill., 1945. Charles C. Thomas. Price $10.50.

Naturally, this work will appeal in the main to ophthomologists but the well read physician, internist or surgeon, would do well to dip now and then between its covers.

The book deals with the relationship of the eye to the brain, showing the effect of certain diseases of the brain on the eyes. Thoroughly covered are such subjects as the Embryological Development of the Neural Structures of the Eye, The Visual System, The Visual Cortical Areas of the Brain and Associated Tracts and Motor Nerves of the Eye, The Sensory Nerves to the Eye, The Auditory Nerves, Ocular Reflexes, The Cerebrospinal Fluid System of the Brain, Meningitis and Brain Abscess, Syphilis of the Central Nervous System, Eye Manifestations of Head Injuries, and other interesting and important topics.

There is a Bibliography and Index, and attached to the inside back cover an envelope containing Charts for Recording Lesions Affecting the Visual System.

"The New York Hospital"[8] was written by the Emeritus Professor of Psychiatry, Cornell University Medical College. To workers in his field he needs no introduction. But this book in no wise is a scientific volume. It deals purely with the history of the psychiatric service at The New York Hospital covering a period of one hundred sixty-five years. And to anyone interested in the subject of psychiatry or the historical aspects of medicine in America, this book is one warmly recommended. It will reward the owner or reader with many delightful hours, for it makes for good reading.

We are given an account of the earliest provision for hospital treatment of the mentally ill in the State of New York, which project was instituted in 1771. We are told that although many public institutions subsequently provided for medical care of the mentally ill, New York Hospital pioneered in both public and private care and is today one of only a dozen voluntarily supported hospitals in America offering such treatment.

Five hundred fifty-six pages long, the work is profusely illustrated, and has an Index that shows painstaking care.

Teachers and students of psychiatry and mental hygiene and those interested in social history, as well as the history of psychiatric nursing education, and public welfare, will find this work a "must" —for reading and a good book to own.

[8] The New York Hospital—A History of the Psychiatric Service 1771–1936. By William Logie Russell. New York, 1945. Columbia University Press. Price $7.50.

AUTHOR INDEX TO VOLUME LXX

Abbott, William E., 369
Akopiantz, Levon A., 128
Allen, Frederick M., 283
Altemeier, W. A., 258
Angelo, Gaspar, 354

Bandler, Clarence G., 337
Barber, Robert F., 135
Beck, Carl, 137
Behan, R. J., 268
Berman, Harry, 121
Berman, Jacob K., 360
Bernstein, Phineas, 164
Bisgard, J. Dewey, 95
Blumberg, Nathan, 38
Bortone, Frank, 64
Botsford, Thomas W., 153
Brown, Chester W., 4
Burgess, C. M., 237

Caylor, Harold D., 133
Cianfrani, Theodore, 100
Cohn, Bernard N. E., 401
Collings, G. H., Jr., 58
Conrad, Harold A., 109
Copleman, Benjamin, 197
Curry, G. J., 243

Daughtry, DeWitt C., 374
Downey, James W., 86

Eaton, Chelsea, 83
Ellis, Ralph C., 389

Falk, Henry C., 176
Ferguson, L. Kraeer, 139
Fett, Herbert C., 234
Fish, James E., 109
Foley, William J., 105
Foote, Robert F., 234
Friedman, Emanuel, 401
Fruhlinger, Ben, 126

Gardner, W. James, 232
Gariepy, Louis J., 386
Glaser, Mark Albert, 249
Goldstein, Albert E., 13
Gordon, Charles A., 277
Granet, Emil, 139
Grayzel, David M., 394

Harrison, John H., 153
Hawkins, B. L., 383
Helfrick, J. Rembrandt, 131
Hellendall, Hugo, 320
Henley, Paul G., 386
Hochman, Samuel, 176
Hoffman, Burton P., 394
Horner, H. Ogle, 201

Jenkins, H. B., 118

Kaplan, I. W., 383
Kirschbaum, Harry M., 134
Klotz, Ben, 13
Krida, Arthur, 275

Lazarus, Joseph A., 114
Leveton, Albert L., 49
Lowenberg, Eugene L., 291

Madden, John L., 135
Mainella, Frank, 121
Marks, Morris S., 114
McClintock, Leslie A., 4
McClure, Roy D., 1
McCorriston, C. C., 237
McGregor, Mar W., 249
Melick, Dermont W., 364
Merkle, H. J., 68
Migliaccio, A. V., 261
Mintz, Bernard J., 189

Neary, Edward R., 4

Ovens, J. M., 24

Patterson, F. M. Simmons, 408
Pfeiffer, Damon B., 408
Pollock, Boris, 227
Posch, Joseph L., 369

Ratzan, Martyn C., 213
Reich, Walter J., 341
Robertson, George E., 95
Roen, Philip R., 337
Rubin, Leonard R., 302

Schimmel, Irwin, 308
Schmier, Adolph A., 27
Seitz, V. B., 232
Sibley, William L., 79
Silverman, Harold E., 341
Simon, Harold E., 86
Smith, Orland F., 158
Stept, Raymond, 337

Thompson, S. A., 213
Thompson, Samuel Alcott, 227
Trichel, Burdette E., 153

Wallace, F. T., 412
Weckesser, Elden C., 184
White, J. William, 389
Wilkey, J. Lester, 341
Williams, H. G., 24
Wilson, Harwell, 255
Witwer, Lee, 133

Zisserman, Louis, 38

SUBJECT INDEX TO VOLUME LXX

(Bo.B.) = Bookshelf Browsing; (E.) = Editorial

Abdomen, perforation of wall of, 386
Abortion, criminal, 100
Abscess
  and appendicitis, 386
  brain, and meningitis, 249
  Brodie's, 86
Abscesses, management of, 139
Ambulation, early, after operation (E.), 1
Amputations, war, treatment of, 184
Anesthesia
  obstetrical, intravenous, 283
  refrigeration, 201, 364
Appendicitis, suppurative, and abscess, 386
Appendix
  polyps of, 389
  vermiform, diverticulitis of, 258
Arch, zygomatic, fracture of, 27
Artery, brachial, thrombosis of, 255
Aspects
  historical, of cardiac resuscitation (Bo.B.), 135
  surgical, of blood dyscrasias, 408

Block, cervical, sympathetic, for thrombosis, 255
Blood dyscrasias, 408
Bone, zygomatic, fracture of, 27
Bones, fetal, passed in feces, 126
Book Reviews:
  Clinical Roentgenology of the Digestive Tract, 416
  Control of Pain in Childbirth, 415
  Management of Obstetric Difficulties, 414
  Neuro-Ophthalmology, 417
  New York Hospital—A History of the Psychiatric Service 1771–1936, 418
  Principles and Practice of Surgery, 415
  Radiologic Examination of the Small Intestine, 416
  Treatment of Fractures, 417
Brain abscess and meningitis, 249
Brodie's abscess, 86
Burns, treatment of, 58

Cast, hanging, use of, 369
Cause of maternal death, 277
Chlorophyll for burns, 58
Cholecystitis, gangrenous, 38
Colon, lipomas of, 114
Condition, proctologic, 354
Conditioned to disc (E.), 275
Control of thyroid storm, 308
Correction of stress incontinence in female, 341
Cure of ingrown toenails, 79
Cyst, thyroglossal, excision of, 118
Cysts, management of, 139

Death, maternal, and hemorrhage, 277
Defects, hearing, stethoscope for doctors with, 134
Derangements, internal, of knee, 189
Device for ends of Kirschner wires, 133
Diagnosis, salpingography in, 164
Diaphragm, eventration of, 95
Disc, conditioned to (E.), 275
Disease, pilonidal, 139
Disk, intervertebral, herniated, 24
Diverticulitis of vermiform appendix, 258
Diverticulum, esophageal, 64
Dressing, traction, 232
Duct
  common, reconstruction of, 261
  parotid, repair of, 412
Duodenum, tumors of, 394
Dyscrasias of blood, 408

Elbow, excision of, 243
Esophagus, diverticulum of, 64
Eventration, congenital, of diaphragm, 95
Excision
  of elbow for fractures, 243
  of thyroglossal cyst, 118
Exploration of sinus and fistulous tracts, 197
Extract, adrenal, cortical, for burns, 58
Extremity, gangrene of, 401

Fatigue fractures, 49
Feces, fetal bones passed in, 126
Female, incontinence in, 341
Femur, fractures of, 369
Fistula
  fecal, in gynecological surgery, 176
  of submaxillary gland, 118
Fixation pins, device for ends of, 133
Fluid, amniotic, instillation of, 68
Fracture
  compound, and excision of elbow, 243
  metatarsal, 49
  of femur, 369
  of zygomatic bone and arch, 27
Fusion, spinal, and herniated disk, 24

Gangrene of extremity, 401
Giant cell xanthoma of knee joint, 234
Gland, submaxillary, fistula of, 118
Grafting of skin, 302

Grafts, omental, in thorax, 227
Granulocytopenia and sulfatherapy, 109
Gum acacia in skin grafting, 302

Headgear, postoperative, 27
Hemorrhage as the cause of maternal death, 277
History of cardiac resuscitation (Bo.B), 135
Holder for needle, 128
Hypoproteinemia in surgery of thorax, 213

Incontinence, urinary, in female, 341
Infections, surgical, 4
Injury
  intestinal, 109
    and fecal fistula, 176
Intestine
  injury to, in gynecological surgery, 176
  small, lymphosarcoma of, 121
Intussusception
  and lipomas of colon, 114
  diagnosis and treatment, 158

Joint, knee, xanthoma of, 234

Kirschner wires, device for ends of, 133
Knee
  derangements of, 189
  joint, xanthoma of, 234

Ligation of supernumerary ureter, 13
Lipomas, submucous, of colon, 114
Lymphogranuloma venereum, 320
Lymphosarcoma of small intestine, 121

Male urethra, stricture of, 153
Management
  surgical, of eventration of diaphragm, 95
    of femoral vein thrombosis, 291
March fractures, 49
Medicine, Pre-Columbian (Bo.B.), 268
Meningitis and brain abscess, 249
Mixture of urea-sulfanilamide, 4
Modification
  of operation for ingrown toenails, 79
  of trocar method of instillation, 68
Mortality, maternal, and hemorrhage, 277

Navy, pilonidal disease in, 139
Needle holder, 128

Obstetrics, intravenous anesthesia in, 283
Operation
  early ambulation after (E.), 1
  for ingrown toenails, 79
  instillation of amniotic fluid at close of, 68
  newer trends after, 374

Parotid duct, repair of, 412
Patients with proctologic conditions, 354
Penicillin
  for brain abscess, 249
  for gangrene of extremity, 401
  in intestinal injury, 109
Perforation of abdominal wall, 386
Phthalylsulfathiazole-'sulfathalidine,' 354
Placenta, lymphogranuloma venereum in, 320
Polyps of appendix, 389
Pre-Columbian middle America medicine (Bo.B.), 268
Prostate, resection of, 337
Puerperal deaths in Brooklyn, 277

Reconstruction of common duct with vitallium, 261
Refrigeration anesthesia, 201, 364
Removal of herniated disk, 24
Repair of parotid duct, 412
Resection of prostate and thrombin (topical), 337
Resuscitation, cardiac, history of (Bo.B.), 135
Retractor, anal, 131

Salpingography in surgical diagnosis, 164
Simplification of split skin grafting, 302
Sinus
  exploration of, 197
  pilonidal, treatment for, 360
Sinuses, management of, 139
Skin grafting, simplification of, 302
Spine fusion and herniated disk, 24
Steinmann's pin, device for ends of, 133
Stethoscope for doctors with hearing defects, 134
Storm, thyroid, control of, 308
Stricture of male urethra, 153
Study, clinical, of supernumerary ureter, 13
Sulfadiazine
  for brain abscess, 249
  for gangrene of extremity, 401
  in intestinal injury, 109
Surgery
  after war (E.), 137
  anorectal, retractor for, 131
  gynecological, 176
  in femoral vein thrombosis, 291
  of thorax, 213

Tendovaginitis, bicipital, 383
Testicle, torsion of, 105

Thorax
  omental grafts in, 227
  surgery of, 213
Thrombin (topical) in resection of prostate, 337
Thrombosis
  of brachial artery, 255
  of femoral vein, 291
  postoperative, of iliac vein, 237
Thyroid storm, control of, 308
Toenails, ingrown, cure of, 79
Torsion of testicle, 105
Traction, constant, dressing, 232
Tracts, fistulous, exploration of, 197
Transmission of lymphogranuloma venereum through placenta, 320
Treatment
  for pilonidal sinus, 360
  of burns, 58
  of derangements of knee, 189
  of infections with urea-sulfanilamide, 4
  of intertrochanteric fractures of femur, 369
  of intussusception, 158
  of war amputations, 184
Trends, postoperative, 374
Trocar method for instilling amniotic fluid, 68
Tubes, vitallium, for reconstruction of duct, 261
Tumors of duodenum, 394

Ureter, supernumerary, 13
Urethra, male, stricture of, 153
Use of free omental grafts in thorax, 227

Value of salpingography in diagnosis, 164
Vein
  femoral, thrombosis of, 291
  iliac, thrombosis of, 237
Vitallium in reconstruction of duct, 261

Wall, abdominal, perforation of, 386
War
  amputations, treatment of, 184
  surgery after (E.), 137
Whitehead and his work, 83

Xanthoma of knee joint, 234

The American Journal of Surgery

PUBLISHED MONTHLY BY THE YORKE PUBLISHING COMPANY, INC.
49 WEST 45TH STREET, NEW YORK 19, N. Y.

Editor: THURSTON SCOTT WELTON, M.D., NEW YORK

EDITORIAL BOARD

CARL BECK, *Chicago;* CLAUDE S. BECK, *Clev.;* GEO. R. BRIGHTON, *N.Y.;* MEREDITH F. CAMPBELL, *N.Y.;* JAMES T. CASE, *Chicago;* ISIDORE COHN, *N.O.;* BRADLEY L. COLEY, *N.Y.;* FREDERICK A. COLLER, *Ann Arbor;* PAUL C. COLONNA, *Phila.;* ELLIOTT C. CUTLER, *Boston;* CHARLES A. ELSBERG, *N.Y.;* HERBERT C. FETT, *Brooklyn;* JOHN H. GIBBON, *Phila.;* EMIL GOETSCH, *Brooklyn;* CHARLES A. GORDON, *Brooklyn;* DONALD GUTHRIE, *Sayre, Pa.;* A. E. HERTZLER, *Kansas City;* LOUIS J. HIRSCHMAN, *Detroit;* J. M. HITZROT, *N.Y.;* FREDERICK C. HOLDEN, *N.Y.;* EMILE F. HOLMAN, *San Francisco;* CLAUDE J. HUNT, *Kansas City;* ARNOLD S. JACKSON, *Madison, Wis.;* JOHN E. JENNINGS, *Brooklyn;* W. L. KELLER, *Washington;* T. J. KIRWIN, *N.Y.;* ARTHUR KRIDA, *N.Y.;* A. V. S. LAMBERT, *N.Y.;* MAURICE LENZ, *N.Y.;* H. H. LYLE, *N.Y.;* JEROME M. LYNCH, *N.Y.;* URBAN MAES, *N.O.;* HARRISON S. MARTLAND, *Newark, N.J.;* RUDOLPH MATAS, *N.O.;* ROY D. MCCLURE, *Detroit;* H. C. NAFFZIGER, *San Francisco;* EMIL NOVAK, *Balt.;* CLARENCE R. O'CROWLEY, *Newark, N.J.;* LOUIS E. PHANEUF, *Boston;* EUGENE H. POOL, *N.Y.;* JAMES T. PRIESTLEY, *Rochester, Minn.;* DOUGLAS QUICK, *N.Y.;* N. P. RATHBUN, *Brooklyn;* HUBERT A. ROYSTER, *Raleigh;* HENRY S. RUTH, *Phila.;* M. G. SEELIG, *St. Louis;* J. BENTLEY SQUIER, *N.Y.;* H. J. STANDER, *N.Y.;* GRANT E. WARD, *Baltimore;* J. H. WOOLSEY, *San Francisco.*

NEW SERIES, VOLUME LXX

OCTOBER TO DECEMBER

1945

THE YORKE PUBLISHING COMPANY, INC.
NEW YORK MCMXLV

COPYRIGHT, 1945
BY THE YORKE PUBLISHING COMPANY, INC.
All Rights Reserved

Printed in the United States of America

CONTENTS OF NEW SERIES, VOLUME LXX

ORIGINAL ARTICLES

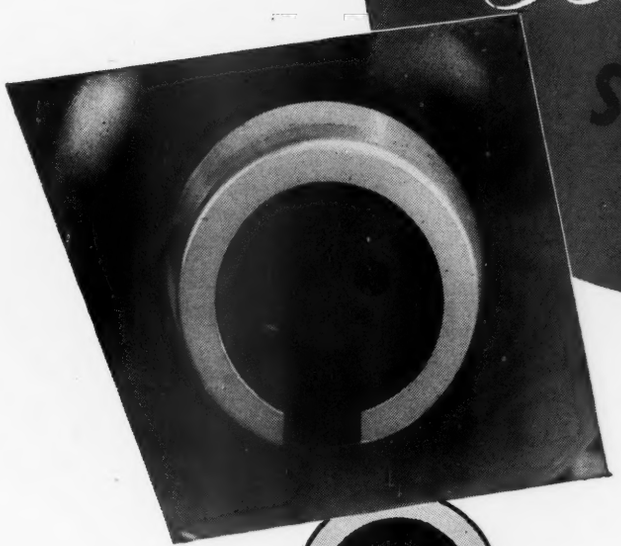
Established Surgical Infections. Treatment with Urea-Sulfanilamide Mixture	*Chester W. Brown* *Leslie A. McClintock* *Edward R. Neary*	4
Ligation of a Supernumerary Ureter. Clinical and Experimental Study	*Albert E. Goldstein* *Ben Klotz*	13
Intervertebral Spine Fusion with Removal of Herniated Intervertebral Disk	*J. M. Owens* *Lieut. Comdr. H. G. Williams*	24
Fracture of the Zygomatic Bone and Arch Postoperative Headgear	*Major Adolph A. Schimer*	27
Acute Suppurative and Gangrenous Cholecystitis	*Nathan Blumberg* *Louis Zisserman*	38
Metatarsal March (Fatigue) Fractures	*Albert L. Leveton*	49
Chlorophyll and Adrenal Cortical Extract in the Local Treatment of Burns	*G. H. Collings, Jr.*	58
Esophageal Diverticulum	*Frank Bortone*	64
Modifications of the Trocar Method with Positive Pressure for Instilling Amniotic Fluid Concentrate Intra-abdominally at the Close of Operations	*H. J. Merkle*	68
Modification of Radical Operation for the Cure of Ingrown Toenails	*Lieut. Col. William L. Sibley*	79
What Was Wrong with Whitehead's Work? An Appraisal of His Rectal Operation	*Chelsea Eaton*	83
Brodie's Abscess. Two Case Reports	*Lieut. James W. Downey* *Major Harold E. Simon*	86
Congenital Eventration of the Diaphragm. Surgical Management	*J. Dewey Bisgard* *George E. Robertson*	95
Criminal Abortion. Three Case Reports	*Theodore Cianfrani*	100
Torsion of the Testicle	*Captain William J. Foley*	105
Granulocytopenia Complicating Sulfadiazine Therapy in a Severe Intestinal Injury. Report of a Case in Which Penicillin Was Employed to Supplement Other Therapeutic Measures	*Colonel James E. Fish* *Major Harold A. Conrad*	109

Submucous Lipomas of Colon with Special Reference to Acute and Chronic Intussusception	*Joseph A. Lazarus* *Morris S. Marks*	114
Fistula of Submaxillary Gland Following Excision of Thyroglossal Cyst	*Lieut. Col. H. B. Jenkins*	118
Lymphosarcoma of the Small Intestine	*Harry Berman* *Captain Frank Mainella*	121
Fetal Bones Passed in the Feces	*Ben Frublinger*	126
Improved Needle Holder	*Levon A. Akopiantz*	128
Anal Retractor for Use in Anorectal Surgery	*J. Rembrandt Helfrick*	131
Device to Protect the Projecting End of Kirschner Wires, Steinmann's Pin or External Fixation Pins	*Harold D. Caylor* *Lee Witwer*	133
Stethoscope for Doctors with Hearing Defects	*Lieut. Col. Harry M. Kirschbaum*	134
Historical Aspects of Cardiac Resuscitation	*Robert F. Barber* *Capt. John L. Madden*	135
Pilonidal Disease. Management of Cysts, Sinuses and Abscesses in Naval Personnel	*Comdr. Emil Granet* *Captain L. Kraeer Ferguson*	139
Stricture of the Male Urethra	*Major Thomas W. Botsford* *Lieut. Col. John H. Harrison* *Capt. Burdette E. Trichel*	153
Intussusception. Diagnosis and Treatment	*Lieut. Comdr. Orland F. Smith*	158
Value of Salpingography in Surgical Diagnosis	*Commander Phineas Bernstein*	164
Intestinal Injury and Fecal Fistula in Gynecological Surgery	*Henry C. Falk* *Samuel Hochman*	176
Primary Treatment of War Amputations	*Major Elden C. Weckesser*	184
Internal Derangements of the Knee. Diagnosis and Treatment	*Major Bernard J. Mintz*	189
Roentgenologic Exploration of Sinus and Fistulous Tracts	*Lieut. Col. Benjamin Copleman*	197
Refrigeration Anesthesia	*H. Ogle Horner*	201
Hypoproteinemia in Surgery of the Thorax	*Martyn C. Ratzan* *S. A. Thompson*	213
Use of Free Omental Grafts in the Thorax. An Experimental Study	*Samuel Alcott Thompson* *Boris Pollock*	227
Constant Traction Dressing	*Lieut. Comdr. W. James Gardner* *V. B. Seitz*	232

Benign Giant Cell Xanthoma of the Knee Joint	*Lieut. Comdr. Robert F. Foote* *Captain Herbert C. Fett*	234
Postoperative Thrombosis of the Iliac Vein	*C. C. McCorriston* *C. M. Burgess*	237
Excision of the Elbow for Multiple Compound Comminuted Fractures	*G. J. Curry*	243
Traumatic Brain Abscess and Meningitis. Cure Effected with Penicillin and Sulfadiazine	*Mark Albert Glaser* *Mar W. McGregor*	249
Thrombosis of the Brachial Artery Treated with Successive Cervical Sympathetic Blocks	*Lieut. Col. Harwell Wilson*	255
Diverticulitis of the Vermiform Appendix	*W. A. Altemeier*	258
Reconstruction of the Common Duct with Vitallium Tubes	*A. V. Migliaccio*	261
Pre-Columbian Middle America Medicine	*R. J. Beban*	268
Hemorrhage as the Most Frequent Cause of Maternal Death. An Analysis of the Puerperal Deaths in Brooklyn, 1944	*Charles A. Gordon*	277
Intravenous Obstetrical Anesthesia. Preliminary Report	*Frederick M. Allen*	283
Surgical Management of Femoral Vein Thrombosis	*Eugene L. Lowenberg*	291
Simplification of Split Skin Grafting. Gum Acacia Technic	*Captain Leonard R. Rubin*	302
Control of the Thyroid Storm	*Captain Irwin Schimmel*	308
Experimental Transmission of Lymphogranuloma Venereum Virus through the Placenta	*Hugo Hellendall*	320
Use of Thrombin (Topical) in Transurethral Resection of the Prostate	*Clarence G. Bandler* *Philip R. Roen* *Raymond Stept*	337
Urinary Stress Incontinence in the Female. A Combined Gyno-urological Approach to Its Correction	*Walter J. Reich* *J. Lester Wilkey* *Harold E. Silverman*	341
Phthalylsulfathiazole-'Sulfathalidine.' A Clinical Evaluation in 122 Patients with Proctologic and Related Conditions	*Gaspar Angelo*	354
A Method of Treatment for Pilonidal Sinus	*Jacob K. Berman*	360
Refrigeration Anesthesia	*Dermont W. Melick*	364

Treatment of Intertrochanteric Fractures of the Femur. The Use of the Hanging Cast	*Capt. Joseph L. Posch* *William E. Abbott*	369
Newer Postoperative Trends	*DeWitt C. Daughtry*	374
Bicipital Tendovaginitis	*Major I. W. Kaplan* *Major B. L. Hawkins*	383
Acute Suppurative Appendicitis with Abscess Formation and Subsequent Perforaction of the Anterior Abdominal Wall	*Louis J. Gariepy* *Paul G. Henley*	386
Polyps of the Appendix	*Lieut. Col. J. William White* *Major Ralph C. Ellis*	389
Benign Tumors of the Duodenum	*Burton P. Hoffman* *David M. Grayzel*	394
Mixed Bacterial Gangrene of an Extremity Treated with Penicillin and Sulfadiazine	*Bernard N. E. Cohn* *Emanuel Friedman*	401
Surgical Aspects of Certain Blood Dyscrasias	*Damon B. Pfeiffer* *F. M. Simmons Patterson*	408
Primary Repair of the Parotid Duct	*F. T. Wallace*	412

ANOTHER *Baxter* SAFEGUARD



Visible Proof of Vacuum

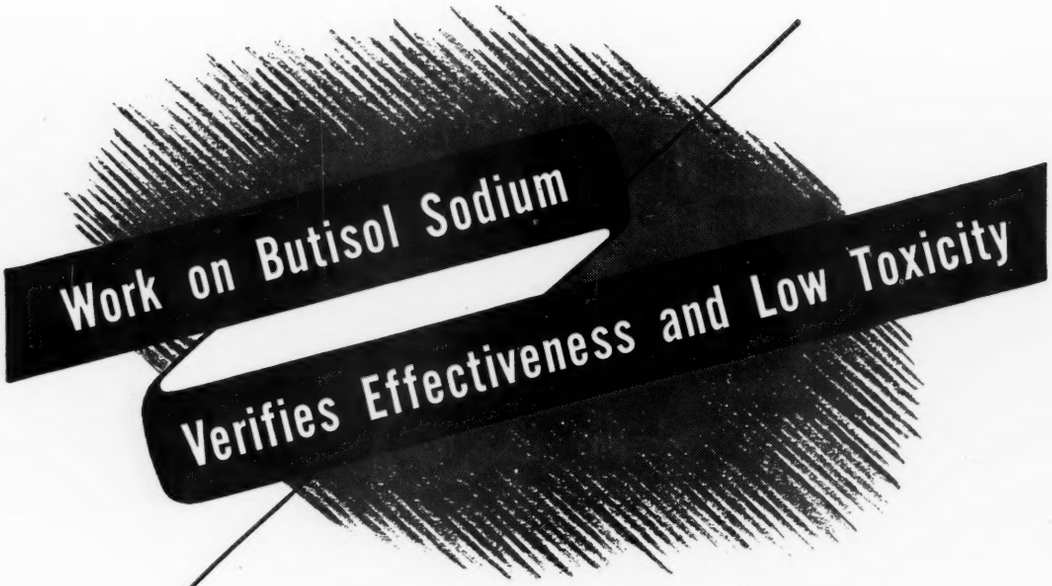
Visible proof that vacuum is present in each Vacoliter — proof that the contents are as pure, as sterile, as pyrogen-free as when they left the laboratory—is provided by the indentations in the rubber disc which seals the stopper . . . and corroborated by the audible intake of air as the disc is removed.

Such safeguards, and Baxter's simple, convenient technique, contribute to a trouble-free parenteral program. No other method is used by so many hospitals.

Manufactured by
BAXTER LABORATORIES, INC.
Glenview, Illinois; Acton, Ontario; London, England

Distributed east of the Rockies by
AMERICAN HOSPITAL SUPPLY CORPORATION
CHICAGO • NEW YORK

Produced and distributed in the Eleven Western States by DON BAXTER, INC., Glendale, Calif.



Described as an "intermediate" between the fast-acting sedatives such as pentobarbital and the long-acting drugs such as phenobarbital and barbital,

BUTISOL SODIUM

(Sodium salt of 5-ethyl-5-secondary butyl barbituric acid "McNeil")

was studied by Gruber et al* and found to have unique pharmacologic properties:

- **duration of action "intermediate" between short-acting and long-acting barbiturates**
- **destruction in the body and not dependent upon renal excretion**
- **low toxicity in effective dosage**
- **therapeutic coefficient on rabbits found to be better than phenobarbital sodium and approximately equal to pentobarbital sodium**
- **little excitement during induction**
- **minimum barbiturate "hangover"**

Butisol Sodium is indicated in insomnia, neuroses, relief of preoperative apprehension, obstetrical hypnosis, daytime sedation and menopausal hysteria.

Supplied in capsules containing 1½ grs.; bottles of 100, 500 and 1000. Elixir Butisol Sodium, 3 gr. per fl. oz. is supplied in bottles of one pint. Clinical trial supply mailed to physicians on request. Caution: Use only as directed.

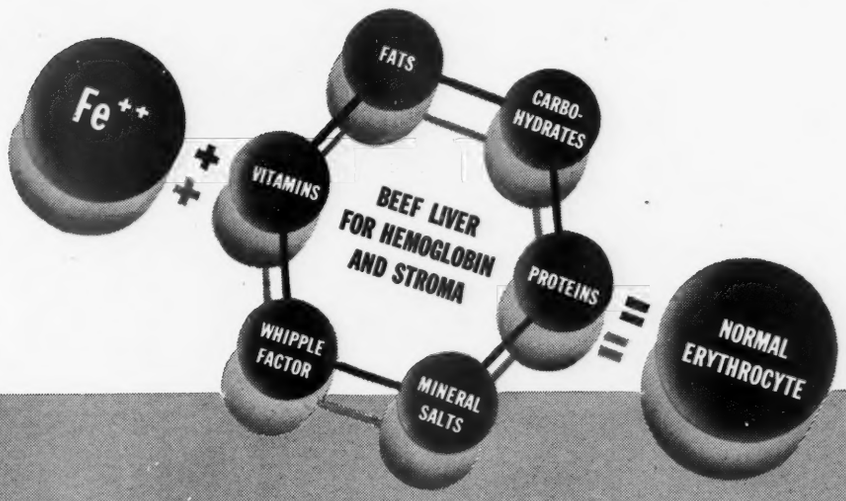
*Gruber, C. M., Ellis, F. W. and Freedman, G. J. Pharmacol. & Exper. Therap. *81*:254 (July) 1944

McNeil Laboratories
INCORPORATED
PHILADELPHIA • PENNSYLVANIA

Wyeth
REG. U.S. PAT. OFF.

CHRONIC ANEMIA

MAY REQUIRE MORE THAN IRON FOR RECOVERY



Accent on Liver

BĒPRON* supplies whole, unfractionated beef liver with saccharated ferrous iron. Liquid in pints and gallons. Capsules in bottles of 100 and 500.

Accent on Iron

HEMATINIC PLASTULES* with Liver Concentrate supply dried ferrous sulfate with liver and yeast concentrates. Bottles of 50, 100 and 1000.

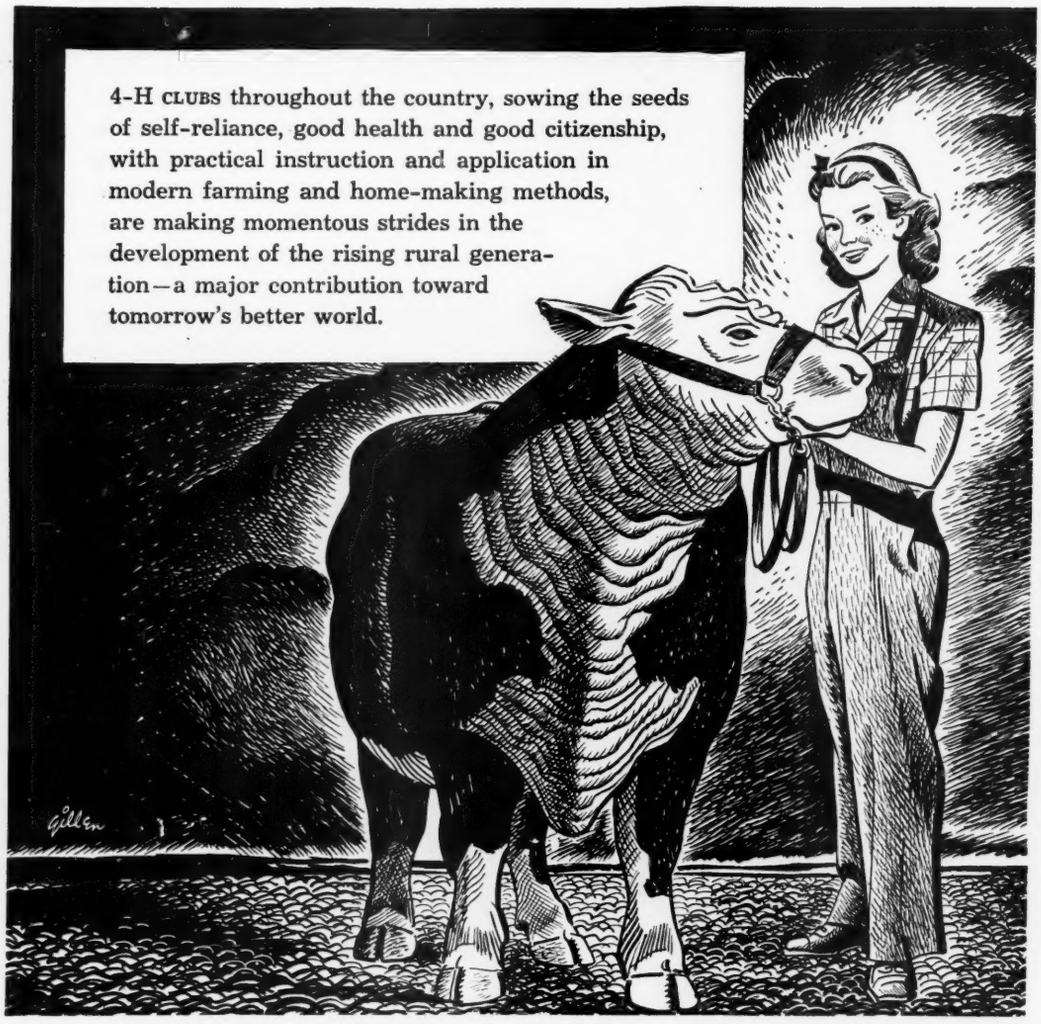
HEMATINIC PLASTULES Plain are effective in uncomplicated iron deficiency anemia. Each Plastule contains 5 grains dried ferrous sulfate with yeast concentrate. Bottles of 50, 100 and 1000.

*REG. U. S. PAT. OFF.

Wyeth

WYETH INCORPORATED • PHILADELPHIA 3 • PA.

Toward a Better World

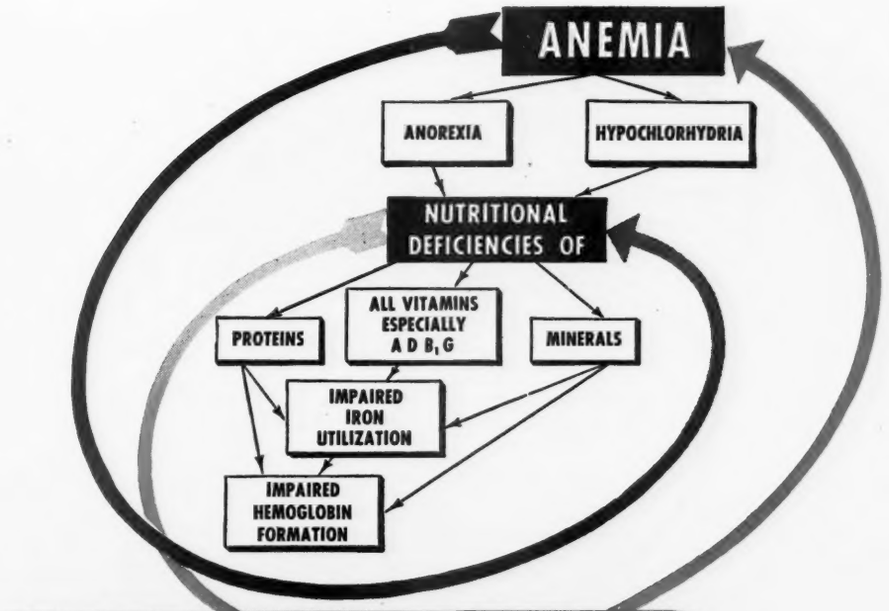

4-H CLUBS throughout the country, sowing the seeds of self-reliance, good health and good citizenship, with practical instruction and application in modern farming and home-making methods, are making momentous strides in the development of the rising rural generation—a major contribution toward tomorrow's better world.
Gillen

Lanteen Medical Laboratories present another notable example of advanced sociological thinking, in Lanteen Products, leaders in their field, produced under the most rigid scientific standards.

Since patients are not mechanically minded, simplicity and ease of handling are prime requisites for continued use. Lanteen Flat Spring Diaphragm is extremely simple to place—it is collapsible in one plane only. No inserter required. Distributed ethically—advertised only to the medical profession—available only upon the recommendation or prescription of a physician. Complete information upon request.

L A N T E E N

COPYRIGHT 1945, LANTEEN MEDICAL LABORATORIES, INC., CHICAGO 10



THE VICIOUS CYCLE OF *Nutritional Deficiency* IN HYPOCHROMIC ANEMIA

Patients with hypochromic anemia resulting from nutritional deficiencies or blood loss exhibit one common feature: With anemia once established, the ensuing reduction of gastric acidity, lack of appetite, and increased fatigability tend to decrease further the food intake, thus promoting or intensifying nutritional deficiencies and the progress of anemia.

Hence anemic patients will be benefited most if not merely iron is supplied (usually but one of the deficient nutrients), but also all the other factors which make for optimal iron absorption and utilization, which lessen fatigability and increase the appetite.

Heptuna provides not only an adequate amount of highly available iron but, in addition, notable quantities of the fat-soluble vitamins A and D, and the B-complex vitamins (partly derived from a vitamin-rich liver extract and yeast).

J. B. ROERIG & COMPANY • 536 Lake Shore Drive, Chicago 11, Illinois

Each Capsule Contains:

Ferrous Sulphate U.S.P.	4½ Grains
Vitamin A (Fish-Liver Oil)	5,000 U.S.P. Units
Vitamin D (Tuna-Liver Oil)	500 U.S.P. Units
Vitamin B_1 (Thiamine Hydrochloride)	2 mg.
Vitamin B_2 (Riboflavin)	2 mg.
Vitamin B_6 (Pyridoxine Hydrochloride)	0.1 mg.
Calcium Pantothenate	0.333 mg.
Niacinamide	10 mg.

Together with a Liver Concentrate (Vitamin fraction) derived from 6.5 Gm. fresh liver and dried yeast U.S.P. Not intended for use in the treatment of pernicious anemia.

Heptuna

a **ROERIG** *Preparation*

COMPLICATIONS FROM PENICILLIN

The use of purer penicillin has markedly reduced such complications as phlebitis, pain at the site of injection, pyrexia, vascular and sympathetic disturbances, as well as muscular cramps.*

When you employ Bristol Penicillin in your practice you will find it:

1. **Uniformly high in potency per milligram and**
2. **Markedly light in color.**

ARMY (E) NAVY

BRISTOL PENICILLIN

*Keys, J.E.L.: Penicillin in Ophthalmology, J.A.M.A. 126: 610 (Nov. 4) 1944.

BRISTOL
LABORATORIES
INCORPORATED

Formerly Cheplin Laboratories Inc.

SYRACUSE 1, NEW YORK

Balance and Surgery

Establishment of favorable nitrogen balance pre-operatively increases the patient's resistance to surgical shock and facilitates rapid, uncomplicated recovery.

Postoperatively, positive nitrogen balance favors wound healing, resistance to infection, and reduction of excess tissue fluid. Good nitrogen nutrition promotes rapid and cheerful convalescence.

Necessary nitrogen intakes often require administration of supplementary nitrogen sources such as protein hydrolysates.

AMINOIDS,* a palatable protein hydrolysate product prepared by enzymic digestion of beef, wheat, milk and yeast, contains all the amino acids present in these protein-rich foods. To spare the amino acids for their exclusive nitrogen uses carbohydrates have been added.

One tablespoonful of AMINOIDS t.i.d. provides approximately 12 grams of protein as hydrolysate. Supplied in granular form in bottles containing 6 oz., AMINOIDS may be taken in any hot or cold liquid, or incorporated in desserts.

Aminoids

REG. U. S. PAT. OFF.

A PROTEIN HYDROLYSATE PRODUCT

For Oral Administration

*The word AMINOIDS is the registered trademark of The Arlington Chemical Company.

Recipe pads available on request.

Arlington

ACCEPTED AMERICAN MEDICAL ASSN

THE ARLINGTON CHEMICAL COMPANY

YONKERS 1 NEW YORK

THE NEW YORK POLYCLINIC
MEDICAL SCHOOL AND HOSPITAL
(ORGANIZED 1881)

(The Pioneer Post-Graduate Medical Institution in America.)

For The General Surgeon

A combined surgical course comprising general surgery, traumatic surgery, abdominal surgery, gastroenterology, proctology, gynecological surgery, urological surgery. Attendance at lectures, witnessing operations, examination of patients pre-operatively and post-operatively and follow-up in the wards post-operatively. Pathology, roentgenology, physical therapy. Cadaver demonstrations in surgical anatomy, thoracic surgery, regional anesthesia. Operative surgery and operative gynecology on the cadaver.

PROCTOLOGY

GASTRO-ENTEROLOGY

and

ALLIED SUBJECTS

FOR INFORMATION ADDRESS

MEDICAL EXECUTIVE OFFICER, 345 West 50th Street, NEW YORK 19

COOK COUNTY
GRADUATE SCHOOL OF MEDICINE
(In affiliation with COOK COUNTY HOSPITAL) Incorporated not for profit

Announces continuous courses

SURGERY—Two Weeks Intensive Course in Surgical Technique starting January 14, January 28, and every two weeks thereafter. Four Weeks Course in General Surgery starting January 28.

GYNECOLOGY—Two Weeks Intensive Course starting February 25. One Week Personal Course in Vaginal Approach to Pelvic Surgery starting February 18.

OBSTETRICS—Two Weeks Intensive Course starting February 11.

ROENTGENOLOGY—Courses in X-Ray, Interpretation, Fluoroscopy, Deep X-ray Therapy available every week.

MEDICINE—Two Weeks Intensive Course starting February 18.

ELECTROCARDIOGRAPHY & HEART DISEASE—One Month Personal Course starting February 1.

GENERAL, INTENSIVE AND SPECIAL COURSES IN ALL BRANCHES OF MEDICINE, SURGERY AND THE SPECIALTIES

Teaching Faculty—Attending Staff of

COOK COUNTY HOSPITAL

Address: Registrar, 427 South Honore Street, Chicago 12, Illinois

ACCEPTED
AMERICAN MEDICAL ASSN
Council on Pharmacy and Chemistry

PREFERRED FOR SURGICAL ANTISEPSIS

Non-toxic

A potent bactericide

Virtually non-irritating

Prolonged effectiveness

in presence of serum

℞ Azochloramid

Brand of Chloroazodin U.S.P.

THE STABLE CHLORAMINE FOR "DAKINIZATION"

Trademark "AZOCHLORAMID" Reg. U.S. Pat. Off.

ARMY E NAVY

W&T

WALLACE & TIERNAN Products, Inc. • Belleville 9, N. J.

Wendel's CATHETER RECEPTACLE

FOR THE WELFARE AND COMFORT OF THE PATIENT

C6002—Wendel's Catheter Receptacle (patent pending) with adjustable Leather Headband. $7.50 each

This appliance has been designed to provide a light, secure, comfortable support for the nasal tube, which is used in continuous gastric lavage, continuous oxygen and heliun-oxygen therapy or any type of procedure which may require the continual use of a nasal catheter.

Because of its construction, this appliance allows the patient to wear glasses comfortably, wash his face without removing or dislodging the catheter and eliminates the discomfort so often caused by adhesive allergy, loosening of adhesive tape from perspiration; or, in men, the discomfort caused by adhesive in the beard.

This appliance allows for adjustment according to the size of the head so that it may be used for a child or adult. This adjustment principle permits application of the appliance with enough security to warrant its use on irrational patients with greater success than heretofore obtained.

This appliance may also be used as a retainer for in-dwelling catheters. It can easily be strapped to the thigh. There is not the inconvenience of adhesive tape on the external genitalia and pubic hair.

Soft Rubber Tubes and Catheters up to size 16 can be used with this Apparatus.

FRED. HASLAM & CO. INC. 83 Pulaski Street, Brooklyn, 6, N. Y.

CHARLES EUCHARISTE
DE MEDICIS SAJOUS
1853-1929

Fearless in expression of his views, and brilliant in observation and assessment of physiologic phenomena, Sajous was an apostle as well as a master builder of endocrinology. For him there was created at the University of Pennsylvania the first chair of endocrinology in the history of medicine.

MASTER BUILDERS
of Endocrinology

To do our utmost for the furtherance of knowledge and progress in medical science is our obligation to those who labored for that larger comprehension of truth.

The Harrower Laboratory, Inc., is pledged to rigid adherence to high scientific and technical standards in the development of specialized products for the physician and research scientist. You can specify Harrower with the confidence that your patients will receive the full benefit of the medication prescribed.

The HARROWER LABORATORY, Inc.
GLENDALE 5, CALIFORNIA
NEW YORK 7 DALLAS 1 CHICAGO 1

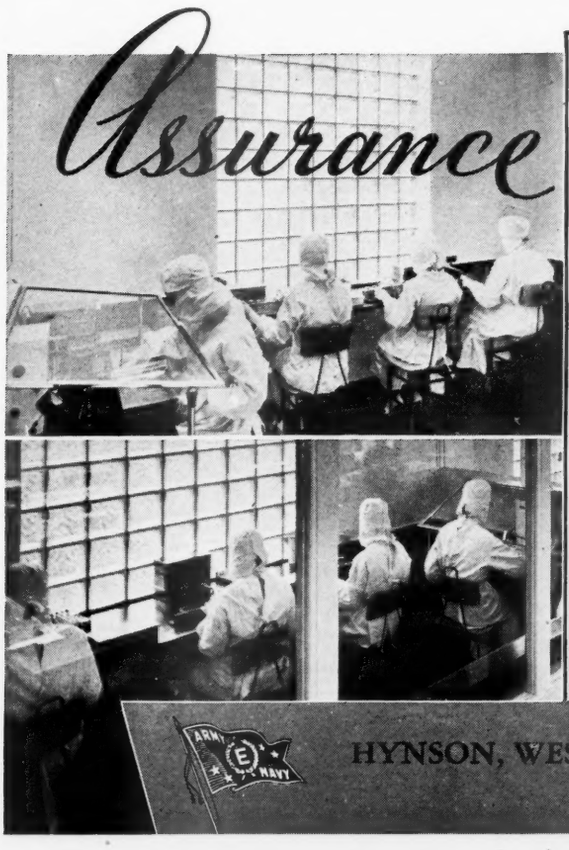
USE

LAVORIS

When Colds Are Prevalent

Keep the mouth and throat thoroughly clean

A SIMPLE TEST — Rinse mouth and throat thoroughly with Lavoris diluted half with water, and expel into basin of clear water. Note the amount of stringy matter expelled.



Sterile ampule production by the H. W. & D. system assures the physician and druggist of the most modern and carefully controlled methods.

The plan of operation and much of the equipment were designed by the H. W. & D. staff to provide aseptic technique through all stages from the preparation of solutions to the final sealing of ampules.

Chemical and biological controls and inspections throughout the process insure product uniformity and sterility.

The physician has assurance in using such H. W. & D. ampule products as Lutein, Phenolsulfonphthalein, Bromsulphalein, Indigo Carmine and Bromsalizol.

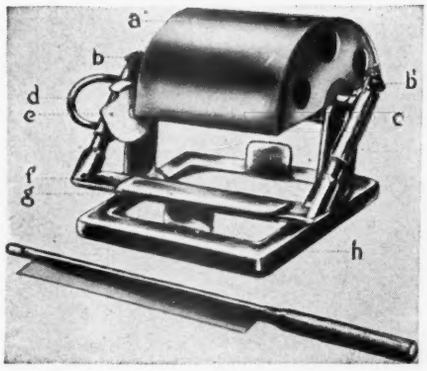
Complete list on request.

HW&D

HYNSON, WESTCOTT & DUNNING, INC.

Baltimore 1, Maryland

PADGETT-HOOD DERMATOME



By means of this unique instrument a sheet of skin of uniform thickness may be cut at any predetermined level the size of the drum (4 x 8 inches) from any area of the body. Those who have used the dermatome state that it simplifies the technique and enlarges considerably the whole field of skin grafting. Same blade used for drum may be placed in handle and used to cut razor grafts or for honing blade. Rubber cement for the drum and donor area also is available, as well as a knife sharpening service.

Manufactured and sold by

The Kansas City Assemblage Company

609 EAST 17th ST., KANSAS CITY 8, MO.

IODINE . . . A PREFERRED ANTISEPTIC

Quick and Lasting . . .

Reliance which the Profession has placed on Iodine for so many years is a tribute to its efficiency.
In preoperative skin disinfection, as an antiseptic for use in the office and on calls, Iodine provides quick bactericidal efficiency and lasting effectiveness.

★ **IODINE** *Foe of Infection* ★

Iodine Educational Bureau, Inc. 120 Broadway, New York 5, N. Y.

Coming!

The American Journal of Surgery

Malformations of the Uterus JULIUS JARCHO, New York

Arthrotomy Approaches in the Lower Extremity
ROSS SUTHERLAND and M. JOHN ROWE, JR., Long Beach, Calif.

The Physick-Sellheim Principle of Extraperitoneal Cesarean Section
JAMES V. RICCI and JAMES P. MARR, New York

Studies on Neuromuscular Dysfunction. Neostigmine Therapy of Chronic Disability Following Fractures
JOHN ADRIANI and LIEUT. D. ROMAN-VEGA, New Orleans

Saddle Block Anesthesia CHARLES STANLEY WHITE, Washington, D. C.

Evaluation of the Treatment of Cancer of the Breast
HERMAN KABAT and CHARLES W. JONES, Washington, D. C.

A PRACTICAL JOURNAL BUILT ON MERIT

Though the Diet May Still Be Restricted

In the postsurgical period, when speed of recovery depends so much on nutrition, need for B vitamins is increased at the very time when the diet perforce must be limited and when digestion so frequently is impaired. When supplementation with B vitamins is made routine as soon as semi-solid foods are tolerated by the patient, a quicker return to normal strength may be expected.

NOVIPLEX provides the essential components of the B complex in approximately the proportions in which they are required by the human organism. Since it is largely derived from high potency yeast concentrate, NOVIPLEX supplies *all* of the natural B complex factors, including choline, inositol, and biotin.

NOVIPLEX

Each capsule of Noviplex contains:

Thiamine hydrochloride (B_1)....2.5 mg.
Riboflavin (B_2, G).....1.5 mg.
Niacinamide.....15.0 mg.
Pyridoxine hydrochloride (B_6)...0.5 mg.
Calcium pantothenate.....1.0 mg.

Plus all other factors naturally occurring in yeast concentrate. Noviplex is supplied in bottles of 100, 500 and 1000 capsules.

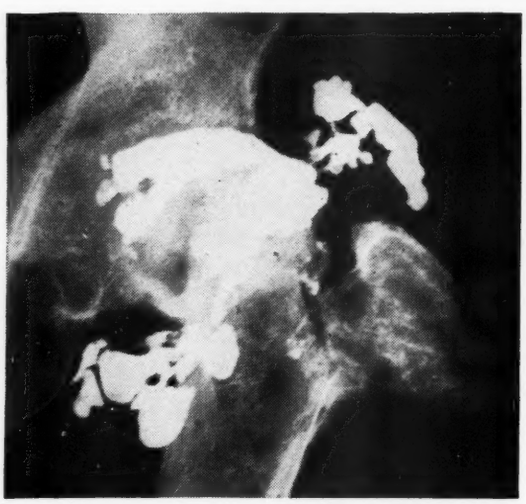
THE S. E. MASSENGILL COMPANY
Bristol, Tenn.-Va.

NEW YORK • SAN FRANCISCO • KANSAS CITY SEMCO

THE ADVANTAGES OF LIPIODOL DIAGNOSIS

In Fistula and Sinus Tracts

In the extirpation of fistula and sinus tracts lipiodolography renders a signal service to the surgeon. It delineates—sharply and precisely—the extent and communication of fistulas as well as the configuration of sinus tracts resulting from tissue necrosis, trauma, and foreign bodies. Lipiodolography demonstrates empyema cavities and abnormal communications of the tracheobronchial tree.



Lipiodol, presenting iodine (40%) in firm chemical union with poppyseed oil, is notable for its safety. Its use is rarely attended by untoward local or systemic reaction, even in tuberculous affections. Its radiopacity is uniform and sufficiently dense to permit differentiation of the shadow of Lipiodol from those cast by the most opaque anatomic structures.

E. FOUGERA & CO., INC.
75 Varick Street ***Distributors*** **New York 13, N. Y.**

Lipiodol (LAFAY)

Lipiodol, made in the U. S. A., is available in various sizes of ampules and in 20 cc. vials.

ACCEPTED AMERICAN MEDICAL ASSN. Council on Pharmacy and Chemistry

HYDROSULPHOSOL

Provides all 9 desired requisites as a superior therapy in thermal, acid and caustic burns.

Provides for mechanical exclusion of air at site of burn • Insures prompt relief of pain • Aids in abating burn shock • Bacteriostatic influence • Non-toxic effect • STIMULATES TISSUE REPAIR • Rapidly reduces inflammation and edema • Results in absence or marked reduction of scar tissue • Tends to shorten convalescent period.

HYDROSULPHOSOL is a true solution of sulfur bearing compounds resulting solely from the reduction of flowers of sulfur by a catalytic process. In aqueous solution, it is capable of rapidly releasing its high concentration of sulfhydryl ion (-SH radical) in such form as can be effectively utilized by the body in the synthesis of sulfur-containing amino acids . . . functionally active in cell stimulation and directly related to tissue respiration and repair.

Unlike the sulfa group and many other sulfur compounds, Hydrosulphosol is non-toxic when administered orally or topically applied in heavy concentrations, and will not result in damage to liver and kidney function.

Reprints of scientific papers by authoritative investigators available on request.

AVAILABLE FORMS

AQUEOUS SOLUTION:
Bottles of 8 fluid ounces.

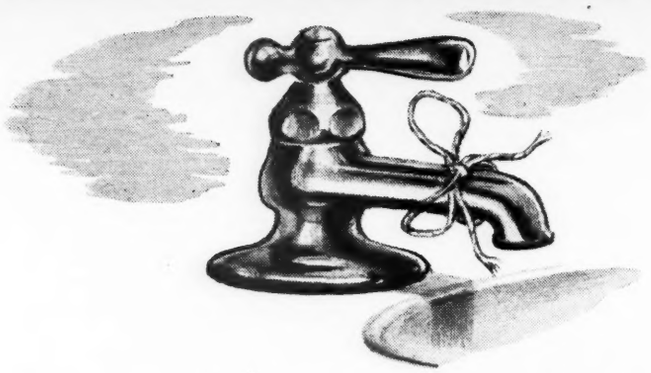
OINTMENT:
Jars of 1 lb.
Tubes of ⅗ oz.

•

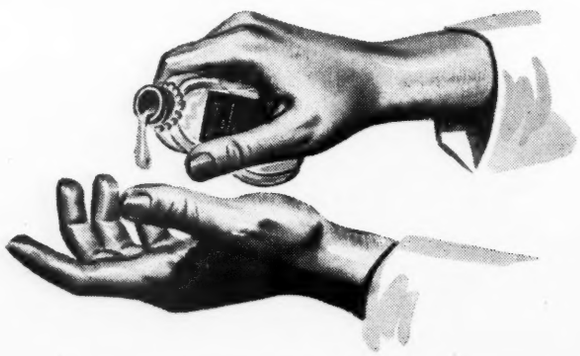
ORDER TODAY through your surgical or hospital supplier.

DAVIS EMERGENCY EQUIPMENT CO., INC.
Pharmaceutical Division
76 HALLECK STREET NEWARK 4, N. J.

WHAT'S A STRING DOING ON A FAUCET?



It's to remind you NOT to wash your hands—until you *first* apply Trushay



Frequent washings remove the skin's natural lubricant . . . leave your hands red and rough. A few drops of Trushay, applied *before* washing, forms an invisible film which helps guard against the harsh effects of cleansing agents... keeps hands soft and pliable.

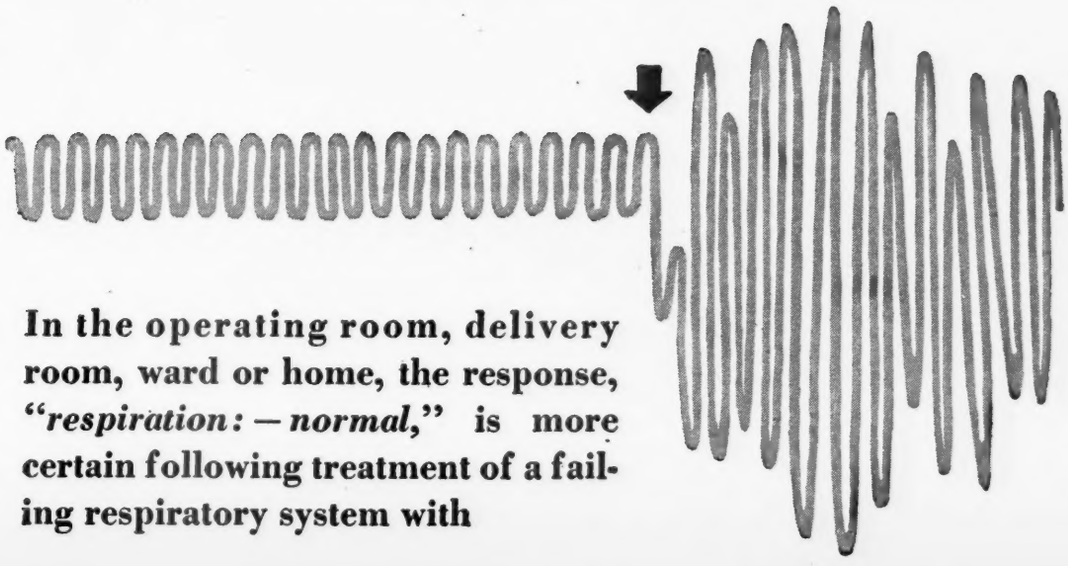
If your hands are *already* dry and rough, Trushay will help restore their natural smoothness.

Recommend Trushay to patients. They will appreciate your interest.

Trushay THE "BEFOREHAND" LOTION

A *Product of* BRISTOL-MYERS COMPANY, 19 NF W. 50th St., N. Y. 20, N. Y.

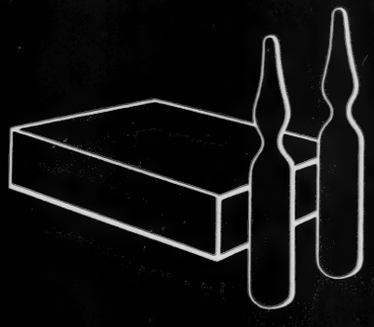
"respiration:—normal"



In the operating room, delivery room, ward or home, the response, *"respiration: — normal,"* is more certain following treatment of a failing respiratory system with

LOBELIN

A more normal respiratory function may be restored by the intravenous or intramuscular use of LOBELIN (alpha-lobeline-hydrochloride) in respiratory distress or arrest due to surgical and traumatic shock, anesthetic crises or asphyxia neonatorum.



LOBELIN-BISCHOFF in ampules of 1 cc. either adult dose (100 mgm., 3/20 gr.) or infant dose (30 mgm., 1/20 gr.).

Bischoff

ERNST BISCHOFF COMPANY, INC. • IVORYTON, CONN.

Particularly After Abdominal Surgery

In the early postsurgical feeding of the patient who has undergone abdominal surgery, cereals prove especially advantageous. Of the foods equivalent in nutrient value, they represent probably the least burden for the digestive tract. In view of the manipulation of the digestive apparatus, which abdominal surgery usually entails, this property of the dish composed of cereal (ready to eat or to be cooked), milk, and sugar, appears especially important.

Nutritionwise, this dish contributes to the satisfaction of many needs. It provides biologically adequate protein, quickly utilized carbohydrate, easily emulsified fat rich in unsaturated fatty acids, ample thiamine for its utilization, other B vitamins, and essential minerals.

Except in the case of cereals made purposely different through bran content, it is thoroughly bland, easily digested, and utilized almost quantitatively. It contains virtually no inert matter, hence presents the minimum of digestive burden.

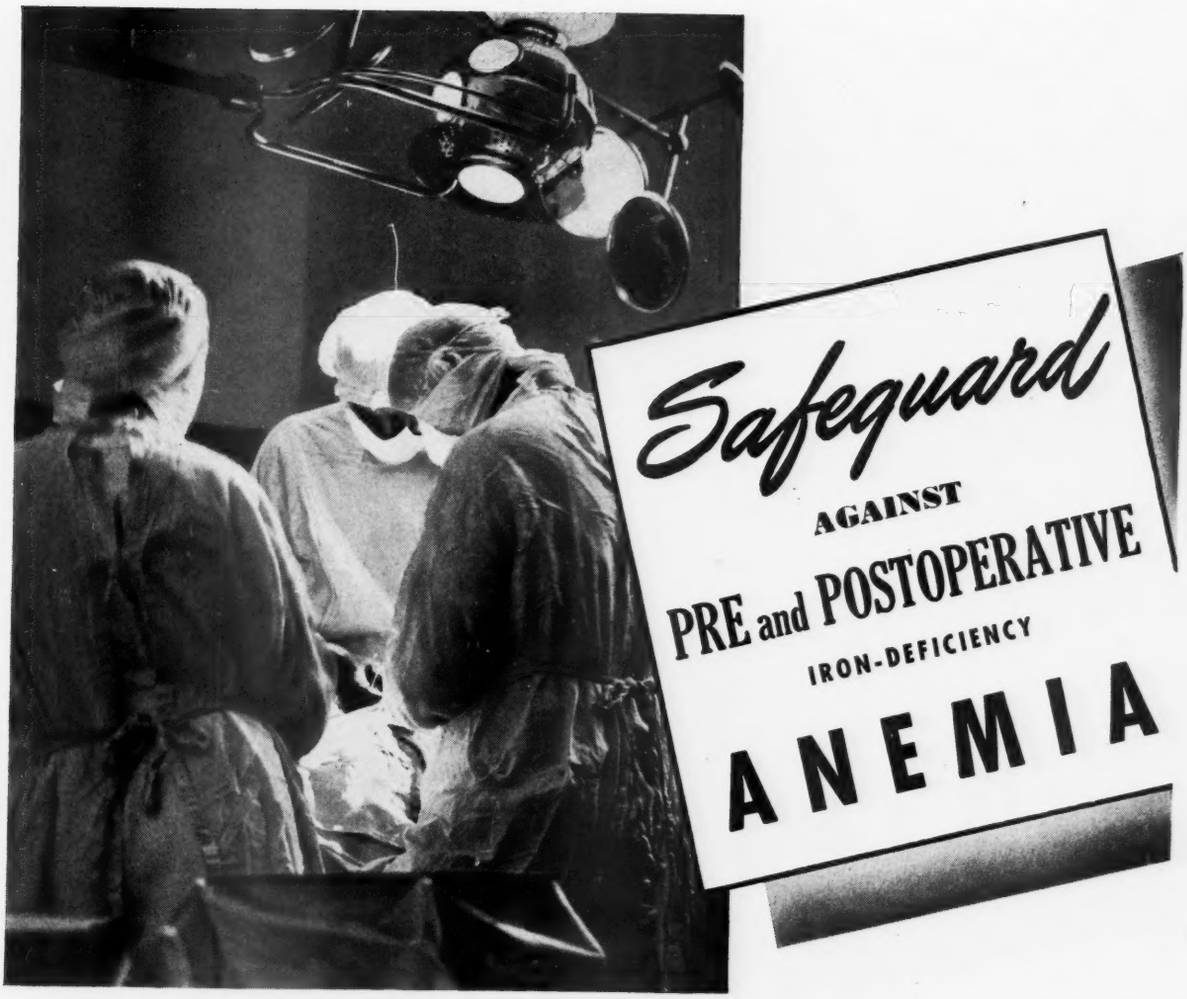
The nutritional contribution of 1 ounce of cereal (whole-grain, enriched, or restored to whole-grain values of thiamine, niacin, and iron), 4 ounces of milk, and 1 teaspoonful of sugar, is shown in this table of composite averages:

Calories	**202**
Protein	**7.1 Gm.**
Fat	**5.0 Gm.**
Carbohydrate	**33 Gm.**
Calcium	**156 mg.**
Phosphorus	**206 mg.**
Iron	**1.6 mg.**
Thiamine	**0.17 mg.**
Riboflavin	**0.24 mg.**
Niacin	**1.4 mg.**

The presence of this seal indicates that all nutritional statements in this advertisement have been found acceptable by the Council on Foods and Nutrition of the American Medical Association.

CEREAL INSTITUTE, INC.

135 SOUTH LA SALLE STREET · CHICAGO 3



Iron-deficiency anemia is a factor to be considered in pre and postoperative conditions. Hence, we suggest that you prescribe Copperin routinely for a period preceding and following surgery. Copperin stimulates the hematopoietic system—provides material for replacement of hemoglobin—increases the red blood cell count.

Because in Copperin iron ammonium citrate is combined with the catalyst copper sulphate, there is a greater utilization of the iron by the system. For this reason the iron content per capsule is purposely small—32 Mgm. As there is no stomach irritation or constipating effect from Copperin, it is exceptionally well adapted to routine use. In two strengths: Copperin "A" for adults; Copperin "B" for children.

Liberal professional samples gladly sent on request

MYRON L. WALKER COMPANY, Inc.
Mount Vernon **New York**

What's the other thing we ought to do this Christmas?

FOR the last four years, the Christmas phrase "Peace on earth, good will to man" has had a pretty hollow, bitter ring.

This year, it won't.

And surely, one thing each of us will want to do this Christmas is to give thanks that peace has finally come to us—both peace—and victory.

One other thing we ought to do:

In our giving, this year, let's choose—first—the kind of gift that helped to bring us peace and victory and will now help us to enjoy them.

★

Victory Bonds take care of the men who fought for us—provide money to heal them, to give them a fresh start in the country they saved.

Victory Bonds help to insure a sound, prosperous country for us all to live and work in.

Victory Bonds mean protection in emergencies—and extra cash for things we want to do ten years from now.

★

Choose—first—the finest gift in all the world, this Christmas.

Give Victory Bonds!

Give the finest gift of all – VICTORY BONDS!

THE AMERICAN JOURNAL OF SURGERY

This is an official U. S. Treasury advertisement—prepared under auspices of Treasury Department and War Advertising Council

★ ★

special uses for

BASAL ANESTHESIA

Smooth induction of anesthesia without excitement, as obtained by the rectal administration of Avertin with amylene hydrate, is of particular value in the nervous and apprehensive thyrotoxic patient.

thyroid surgery

Avertin with amylene hydrate tends to lower the intracranial pressure and has been found especially suitable for neurosurgery.

brain surgery

Avertin with amylene hydrate can not cause pulmonary irritation since it is excreted quantitatively by the kidneys. And it decreases the amount of inhalation anesthetic subsequently needed by one-half.

in presence of pulmonary disease

Basal anesthesia keeps the patient asleep and ready for radical surgery, while frozen sections, pathologic examinations and consultation are being made.

biopsy procedures

WRITE FOR DETAILED INFORMATION

Avertin

Trademark Reg. U. S. Pat. Off. & Canada

Brand of TRIBROMETHANOL

WITH AMYLENE HYDRATE

Winthrop Chemical Company, Inc.

Pharmaceuticals of merit for the physician • New York 13, N. Y. • Windsor, Ont.

Inclined to be CHOOSY?

"Every patient to her own taste" is an important consideration in prescribing contraceptives . . . that's why physicians welcome *Ortho-Creme* as a worthy companion product to Ortho-Gynol Vaginal *Jelly*. • Ortho-Creme is a soft, white preparation with all the qualities of a fine cosmetic cream appreciated by so many women. • In addition to its esthetic features, Ortho-Creme has all of the desirable properties of an effective chemical contraceptive. • If you prefer to prescribe a cream, we suggest Ortho-Creme Vaginal Cream.

ORTHO PHARMACEUTICAL CORP., LINDEN, N. J.

ortho-creme
VAGINAL CREAM

ACTIVE INGREDIENTS: ricinoleic acid, 0.75%, boric acid, 2.00%, sodium lauryl sulphate, 0.28%.

The American Journal of Surgery

ADVERTISERS INDEX

Instruments and Apparatus

A. S. Aloe Company ..... *November*
American Cystoscope Makers, Inc. ... 9
American Sterilizer Company 15
Austenal Laboratories, Inc 8
Bard-Parker Co., Inc 6
Becton, Dickinson & Co 12
The Birtcher Corp 18
Clay-Adams Co., Inc ..... *November*
General Electric X-ray Corp ..... *November*
Fred Haslam & Co., Inc 41
The Kansas City Assemblage Co. ... 43
Kny-Scheerer Corp ..... *November*
Geo. P. Pilling & Son Co ..... *November*
Singer Sewing Machine Company 13
J. Sklar Manufacturing Co 11
C. M. Sorenson Co., Inc ..... *November*
The Tower Co., Inc 14
Weck Manufacturing Co ..... *October*

Sutures

The Armour Laboratories ... *Insert Facing P. 20*
Bauer & Black 7
Davis & Geck, Inc ..... *Insert Facing 2nd Cover*
J. A. Deknatel & Sons, Inc ..... *November*
Ethicon Suture Laboratories 19
Gudebrod Bros. Silk Co., Inc 10

Pharmaceuticals

Abbott Laboratories 24
American Hospital Supply Corp 33
The Arlington Chemical Company ... 39
Ernst Bischoff Co., Inc 49
Bristol Laboratories 38
Bristol-Myers Company 48
Burroughs Wellcome & Co 25
Chatham Pharmaceuticals, Inc ..... *November*
Ciba Pharmaceutical Products, Inc ... *Back Cover*
Commercial Solvents Corporation 22–23
Davis Emergency Equipment Co., Inc. 47
E. Fougera & Co., Inc 46
The Harrower Laboratory, Inc 42
Hoffmann-La Roche, Inc 5
Hynson, Westcott & Dunning 43
Iodine Educational Bureau, Inc 44
Lanteen Medical Laboratories, Inc ... 36
The Lavoris Company 42
Thos. Leeming & Co., Inc 1
Eli Lilly and Company ..... *November*
The S. E. Massengill Company 45
Merck & Company ..... *November*
The Wm. S. Merrell Company ..... *November*
McNeil Laboratories, Inc 34
National Drug Co 28
Ortho Products, Inc 54
Parke, Davis & Co ..... *November*
J. B. Roerig & Company 37
Schering Corporation 29
Smith, Kline & French Laboratories .. 30
E. R. Squibb & Sons 27
Frederick Stearns & Company 31
The Upjohn Company ..... *November*
Myron L. Walker Co., Inc 51
Wallace & Tiernan Products, Inc 41
Wm. R. Warner & Co., Inc 26
White Laboratories, Inc 16–17
Winthrop Chemical Co., Inc 2, 53
J. Wyeth, Inc 35

Hospital Supplies

A. S. Aloe, Company ..... *November*
American Hospital Supply Corp 33
Becton, Dickinson & Co 12
Cutter Laboratories ..... *November*
General Electric X-ray Corp ..... *November*
Fred Haslam & Co., Inc 41
Johnson & Johnson 32
Macalaster Bicknell Company 21
Mallinckrodt Chemical Works 20
J. Sklar Manufacturing Co 11
C. M. Sorensen Co., Inc ..... *November*
The Tower Co., Inc 14

Post-Graduate Instruction

Cook County Grad. Sch. of Med 40
N. Y. Polyclinic Med. School 40

Foods

Cereal Institute Inc 50
The Wander Company ..... *November*

Miscellaneous

U. S. Treasury 52

In critical moments — 5 cc. or more

Many years of clinical experience with CORAMINE* (pyridine-beta-carboxylic acid diethylamide) have demonstrated that satisfactory results cannot be expected from an injection of an inadequate quantity in shock conditions. A single intravenous injection of at least 5 cc. is necessary to restore respiration and circulation, as well as to increase intramuscular pressure. Subsequent maintenance dosage of 1.5, 3.0, or even 5.0 cc. intramuscularly three or four times daily usually follows.

SHOCK due to trauma, surgery, anesthesia, extensive burns.

ASPHYXIA — neonatorum, drowning.

POISONING due to opiates, hypnotics, alcohol, carbon monoxide.

CORAMINE

5 cc. Ampuls — Cartons of 3 and 12

*Trade Mark Reg. U.S. Pat. Off.

a Ciba Product

CIBA PHARMACEUTICAL PRODUCTS, INC.
SUMMIT, NEW JERSEY
IN CANADA, CIBA COMPANY LIMITED, MONTREAL